WESTERN STATES PORTLAND CEMENT CO.

JACKSON MICH.

INDEPENDENCE KANS.

CEWENT CO
PORTLAND

THE WESTERN STATES

PORTLAND CEMENT COMPANY.

...LLED IN PORTLAND CEMENT.)

The entire data of this Prospectus is based on actual conditions existing today; the prevailing prices of the manufactured product, existing rates of transportation and the cost of production. Our information is obtained from the United States Geological Surveys, Government Reports, Directory of American Cement Industries, *Cement and Engineering News*, *Cement and Slate*, *Cement*, and other sources no less authentic.


STONE AND THE YOUTH CEMENT

PANTHEON AT ROME

The Pantheon at Rome is the most perfect existing classical building in that famous old city. It was built by Agrippa, 27 B. C., nearly 2000 years ago. The circular walls are about 20 feet in thickness, and the roof is a hemispherical cement concrete dome with a thirty-foot opening in the top and spanning in the clear 142 feet 6 inches. This is the most remarkable instance in the world's history showing the great strength, durability, and permanence in cement concrete constructions. It has baffled the destructive elements of time for nineteen centuries and shows not a single crack to-day.

THE WESTERN STATES PORTLAND CEMENT COMPANY.

OFFICES: JACKSON, MICHIGAN; INDEPENDENCE, KANSAS.
MILLS: INDEPENDENCE, KANSAS.

AUTHORIZED CAPITAL

Seven per cent. Preferred Stock,	$1,500,000
Common Stock,	2,000,000

In Shares of $100 each.

FULL PAID. NON-ASSESSABLE.

OFFICERS:

W. F. COWHAM, *President.*
H. B. CAMP, *Vice-President.*
J. W. SHOVE, *Secretary.*
N. S. POTTER, *Treasurer.*
A. C. STICH, *Ass't Treasurer.*

BOARD OF DIRECTORS:

W. F. COWHAM, Jackson, Mich.
Sec'y-Gen'l Mgr. Peninsular Portland Cement Co.
President National Portland Cement Co.
President Southern States Portland Cement Co.
President The International Portland Cement Co.

H. B CAMP, Akron, Ohio.
Stockholder Southern States Portland Cement Co.
President Akron Fire-proof Construction Co.
President Barberton Pottery Co.
President Faultless Rubber Co.
President Camp Rubber Co.

A. C. STICH, Independence, Kansas.
President Citizens' National Bank.
President The Coffeyville Vitrified Brick and Tile Company.
Vice-President Independence Gas Company.

N. S. POTTER, Jackson, Mich.
Vice-President Jackson City Bank.
Treasurer Peninsular Portland Cement Co.
Director Southern States Portland Cement Co
Treasurer Jackson Wagon Works.
Treasurer Jackson, Ann Arbor & Detroit R. R.

W. H. L. McCOURTIE, Jackson, Mich.
Proprietor Somerset Stock Farm.
Stockholder Cowham System Portland Cement Mills.

W. H. NIBLICK, Decatur, Indiana.
President Old Adams County Bank, Decatur, Ind.
Vice-President Peninsular Portland Cement Co
Secretary Decatur Egg-Case Co.
Sec'y-Treas. Paragould and Memphis R. R.

S. B. HUTCHINSON, Ypsilanti, Mich.
Manufacturer Veneers.
Stockholder Peninsular Portland Cement Co.
Stockholder Hay & Todd (Ypsilanti Underwear)
Vice-President Sperry & Hutchinson, N.Y.

JOHN W. SHOVE, Jackson, Mich.
Stockholder Peninsular Portland Cement Co.
Director Jackson Sand-Brick Co.

J. S. IRVIN, Toronto, Ontario.
Director Peninsular Portland Cement Co.
Director Southern States Portland Cement Co.
Director International Portland Cement Co.

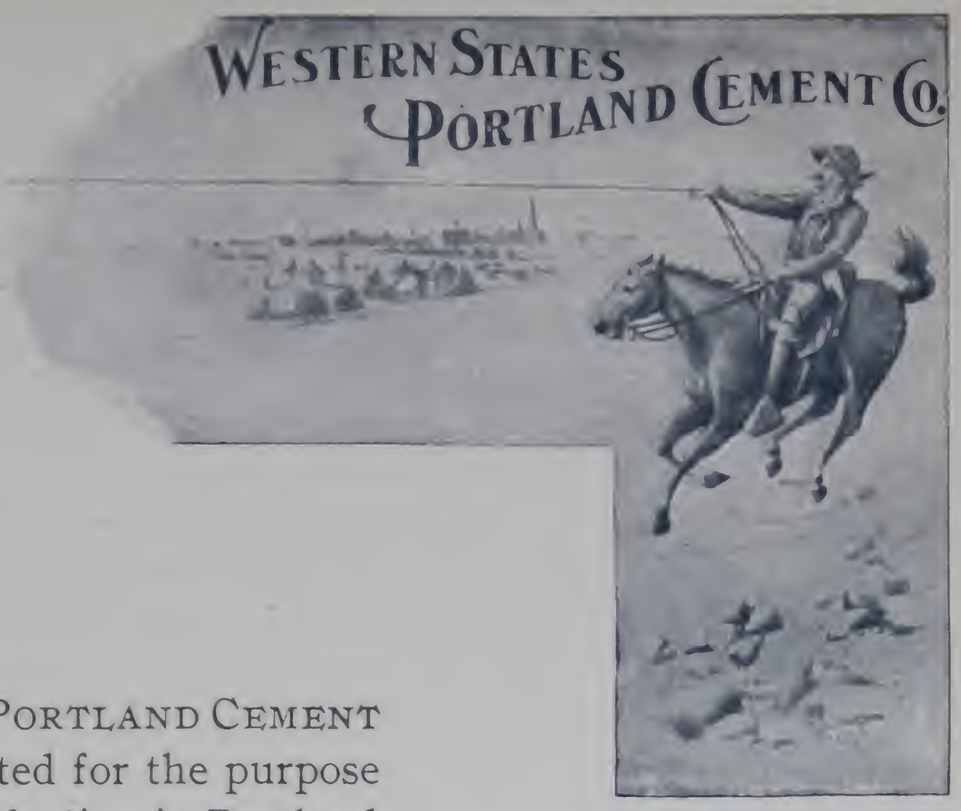
F. E. PALMER, Jackson, Mich.
Manager McCormick Harvesting Machine Co.
Director Peninsular Portland Cement Co.

W. W HAWLEY, Huntington, Indiana.
Director Huntington County Bank.
Director Peninsular Portland Cement Co.
Director Western Lime Company.
Vice-President Pacific Starch Company.

Address all communications to

THE WESTERN STATES PORTLAND CEMENT CO.,
JACKSON, MICHIGAN.

PORTLAND CEMENT BUILDING BLOCKS.



THE WESTERN STATES PORTLAND CEMENT COMPANY is incorporated for the purpose of manufacturing and dealing in Portland Cement, lime, crushed stone and all products of which they form a part; the manufacture and sale of other mineral products and by-products; the mining or digging of minerals, gas and oil, and the sale thereof; the dealing in gas and oil rights; the purchase and leasing of gas, oil and mineral lands and the re-sale and re-leasing thereof. The owning, holding and operating of any rail-road necessary primarily for said Company's operation; the purchase and holding of real estate for the laying out of a town at or near the works of said Company, the erection of buildings thereon, and the sale or lease of any of said lands or buildings; the carrying on of a general merchandise business in such town or at said works. The production, development, transmission and sale of electric and other power, and such other things as may be convenient or necessary to its said business.

The object of this prospectus is to bring THE WESTERN STATES PORTLAND CEMENT COMPANY before the people and to interest them in this enterprise. It will treat briefly of the nature of Portland Cement, the modern process of manufacture, and the varied and constantly increasing uses to which the material is being adapted, illustrating late developments and suggesting the future possibilities of the cement business. It will also present a brief account of the property of the Company; its great natural advantages in the way of raw materials, fuel, location as to markets, transportation, etc.; the nature of the factory proposed to be built and the character and ability of the men upon whom the development of this enterprise rests.

A careful study of the facts here presented will, it is believed, lead to favorable deductions, and the conclusion that this enterprise offers returns seldom equalled in conservative and safe investment.

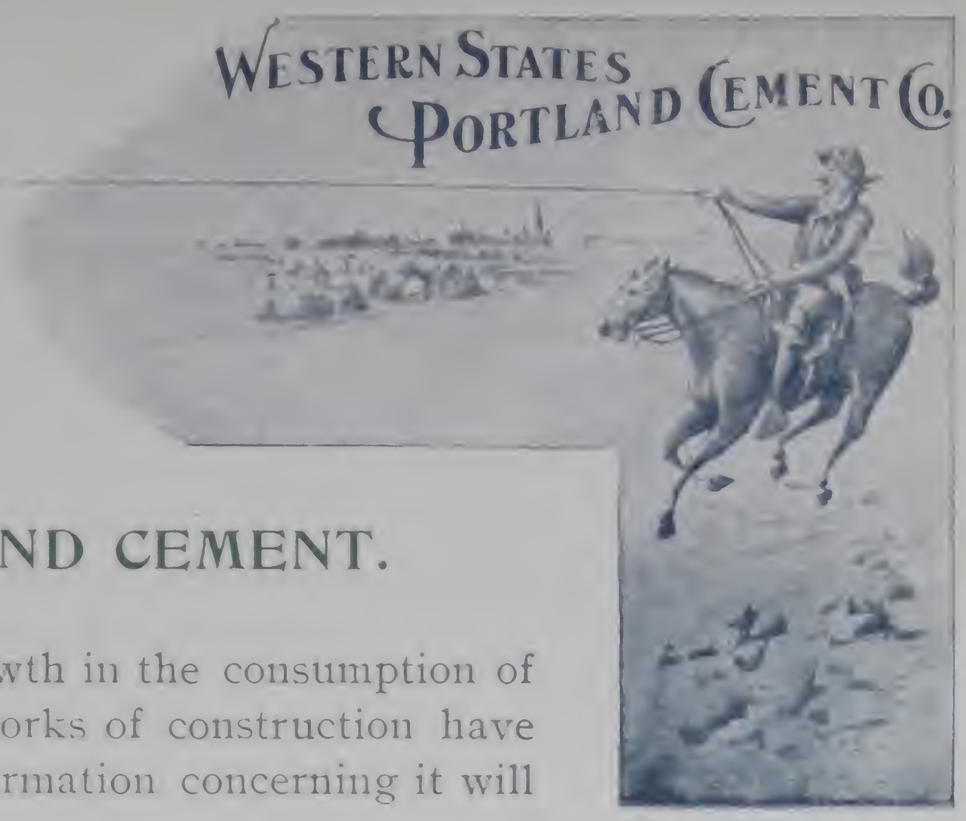
THE CEMENT AGE.

The following table shows the constantly increasing consumption of Portland Cement in the United States since 1880:

1880	229,000	Barrels.
1881	281,000	"
1882	455,406	"
1883	576,418	"
1884	685,768	"
1885	704,396	"
1886	800,032	"
1887	1,320,400	"
1888	2,085,504	"
1889	2,040,356	"
1890	2,275,186	"
1891	3,443,126	"
1892	2,988,094	"
1893	3,264,801	"
1894	3,436,864	"
1895	3,987,719	"
1896	4 532,620	"
1897	4,768,699	"
1898	5,706,102	"
1899	7,760,651	"
1900	10,868,703	"
1901	13,651,225	"
1902	19,136,256	"

For the first half of this period (1880 to 1890 inclusive) the *imports* of Portland Cement averaged 876,497 barrels annually; for the second half of this period (1891 to 1901 inclusive) the *imports* averaged 2,384,457 barrels annually. *Imports* for the first ten months of 1902 show an increase of nearly one million barrels over the corresponding period of 1901, the month of October alone showing the remarkable increase of 335,000 barrels over the month of October, 1901—

AND A CEMENT FAMINE HAS PREVAILED ALMOST CONSTANTLY.



A BRIEF STUDY IN PORTLAND CEMENT.

THERE has recently been so marvelous a growth in the consumption of Portland Cement, and its uses in great works of construction have multiplied so rapidly that a little digest of information concerning it will doubtless prove acceptable here.

Portland Cement is a mechanical mixture varying within narrow limits, containing several definite compounds produced by the proper calcination of finely divided limestone, marl, or other calcareous material with clay. To manufacture a good article there must be proper selection of material, careful workmanship, and the exercise of precaution to prevent entering into, or remaining in, the finished product any inferior or injurious materials.

The limestone or marl supplies calcium, while the clay furnishes silica, alumina and iron oxide. At a temperature of about 3,000 degrees Fahrenheit chemical action takes place in the kiln, resulting in the formation of cement clinkers composed of calcium silicate, calcium aluminate, and aluminum silicate. This clinker, when finely ground, is the Portland Cement of commerce. If the composition, in molecule and mass, is correct in this mixture the addition of the proper amount of water to the finely ground material causes crystallization, whereupon the mass begins to harden into rock and continues to increase in strength for several years before reaching its maximum.

This process is markedly different from that of the manufacture of natural cement which consists simply in the calcination and grinding of a natural rock containing approximately the ingredients for a cement, but lacking uniformity and definiteness in composition. Portland Cements range much higher in specific gravity than do natural cements, and therefore the latter are sometimes called the light cements.

If sufficient care be not exercised in the manufacture of Portland Cement free lime will be present when the product comes from the Kiln, and must be removed by exposure to the atmosphere. If this be not done the free lime will cause swelling of the cement in barrels and checking and "blowing" in finished work. Sufficient care and the correct process of manufacture will, however, make practically unnecessary this maturing and "purging," as it is called.

Magnesia and sulphuric anhydride are always found, to a greater or less extent, in Portland Cement; and occasionally the alkalies, potash and soda, occur also; but these are unimportant if in very small proportions.

Purity of raw materials, their correct chemical combination, a perfect system of manufacture together with experience and scientific accuracy are essential for the production of a uniform, high-grade Portland Cement.

Great strides have recently been made in this direction; the method of manufacture having been continually perfected, until to-day high grade Portland Cement is regarded throughout the world as the best building material known and one of the necessities in all modern construction.

AMERICA'S SUPERIOR PRODUCT, AND PROCESS OF MANUFACTURE.

ONLY a few years ago all Portland Cement was imported from England and Germany. Gradually English makers lost control and the German product became the standard because of the greater care and more advanced methods employed by the Germans, who produced, in consequence, a higher grade of cement. To-day, however, the quality of the cement manufactured in the United States excels the foreign product. This is extremely gratifying, when the degree of technical skill required in making a high-grade article is taken into consideration. The reason for the superiority of American Portland Cements lies, not only in unsurpassed raw materials, but also in the modern and improved method of American manufacture.

No better testimonial of the quality of the Portland Cement now produced in this country can be found than that given in the reports of Mr. Richard Humphrey, Cement Inspector for the City of Philadelphia, for the years 1896 to 1899. These reports include tables showing graphically the results obtained from all cements tested in the Philadelphia City Laboratory in the years mentioned. These tables show that the average of all American cements, both neat and with sand, is distinctly higher than either the English or the German. This evidence, with numerous similar records obtained by government and private engineers, warrants the claim that there is to-day no Portland Cement made in any foreign countries that is equal in quality to the leading American brands.

Mr. William Harper, Manager of the Commercial and Intelligence Bureau of London, in a report says: "The Americans have adopted a process of manufacturing cement by means of rotary roasting mills which will drive England, France and Germany practically out of the field. By the aid of simpler and better machinery the Americans are able to make their article in eight hours, while England, with its ancient, cumbersome equipment, requires three or four weeks. The cost of the American product is less than half that of the English."

So noted an expert as Mr. H. Howard Humphrey, M. I. M. E., A. M. I. C. E., recently read a paper before the British Architectural Association in which he plainly declared: "The cost of producing Portland Cement in America by the rotary kiln process is approximately three-fourths of that of the cheapest process in vogue on the River Thames, and Medway, and the output is also very largely increased."

City Engineer Ericson, of Chicago, is quoted in one of the daily papers of that city as saying: "I do not know of a barrel of Portland Cement of foreign make which has gone into construction here in Chicago during the last two years. There never was a brighter industrial future than that now before American makers of Portland Cement."

A GREAT AND STABLE INDUSTRY.

PORTLAND Cement is daily becoming a more and more important factor in the industrial and commercial development of all countries. Its ready adaptability and superior qualities for use in constructions of all kinds are being demonstrated throughout the land, and it is now regarded as the chief building material of the age.

The consumption of Portland Cement in all countries is increasing with most wonderful rapidity. A reference to the table given on page 8 will show that in the United States alone during the five years preceding the year 1900 the consumption of Portland Cement increased at the rate of nearly 1,000,000 barrels annually. For the years 1900 and 1901 the rate of increase reached the enormous sum of 3,000,000 barrels per annum, and for the year 1902 (although a veritable cement famine prevailed throughout the country and large and important works were delayed or suspended for the lack of cement) the rate of increase was far in excess of that of any previous year, and the total consumption for the year 1902 exceeded 19,000,000 barrels. This is a rate that has not, perhaps, been equalled by any other article used by man, and is due to the multitude of new applications which Portland Cement is constantly finding and its rapidly increasing use in place of other building materials in constructions of all kinds.

It is a noticeable fact that while the consumption of Portland Cement in the United States is constantly increasing at such a tremendous rate, displacing wood, brick, stone, steel, terra cotta and other building materials, the consumption of natural rock and slag cements is rapidly decreasing (the consumption of natural rock cement having decreased from approximately 10,000,000 barrels in the year 1899 to 8,000,000 barrels in the year 1900, and 7,000,000 barrels in the year 1901; and the consumption of slag cement having decreased at even a greater rate), which proves beyond question that Portland Cement by reason of its merit is not only sweeping before it every form of the usual structural materials but is also destined to completely replace natural rock and slag cements in America as it has already done in Germany, where, previous to 1852, every barrel of cement consumed was natural or hydraulic cement.

The supply of cement in the United States can not by any means meet the present demand, much less the increasing demand. Notwithstanding heavy importation, together with a marked increase in home production, a cement famine prevails, in consequence of which the amount consumed is considerably less than that required by the country. Many of the large government, municipal, and railroad contracts are of necessity being carried

over to next season for the sole reason that a sufficient quantity of high-grade Portland Cement cannot be procured. The building of new railroads and canals now projected, also the extension and permanent improvement of the old lines will for years to come consume millions of barrels of Portland Cement.

In view of the great extent of territory still to be developed, the magnitude of building operations, public works, etc., and the general progress and development sure to come, it is absolutely certain that the consumption of Portland Cement in this country will continue to grow from year to year as experience proves the utility and permanency of concrete construction. Furthermore, the consumption of cement per capita in this country is still less than one-third of the amount consumed per capita in some European countries, showing that the industry here is still in a comparatively undeveloped state. It therefore seems certain that no country presents a better field or a more promising market for high-grade Portland Cement than does the United States.

THE NATURAL ADVANTAGES

OF a Portland Cement proposition consists of *raw material, cost of fuel, location of plant as to markets, transportation facilities, choice of mechanical appliances, and price of labor.* All of these THE WESTERN STATES PORTLAND CEMENT COMPANY possesses to an extent unequalled and unknown to any other producer. Coupled with these natural advantages, it is extremely fortunate in having that no less important factor of success, the competent and expert management of men thoroughly familiar with every detail of cement manufacture

PROPERTY.

THE property of THE WESTERN STATES PORTLAND CEMENT COMPANY consists of 395 acres of Portland Cement rock, and clay shale deposits lying side by side but distinctly separate from each other, and situated immediately adjacent to the corporate limits of the city of Independence, Kansas, at the intersection of the Missouri Pacific Railroad, and the Atchison, Topeka and Santa Fe Railroad.

In addition to the properties above mentioned the Company also owns or controls 1383 acres of natural gas territory (of which 1200 acres is proven gas land), lying in the very heart of the great Kansas Gas belt, and upon

which there is a single well capable of producing over fourteen million cubic feet of gas daily. The shale lands above referred to are also underlaid with a vein of bituminous coal which analyses show to be of most excellent quality. The mill site is most favorably located on high ground at the water's edge of Rock Creek, which flows through the property. The raw materials are immediately adjacent to the mill site, which renders it possible to convey them to the factory cheaply and conveniently.

RAW MATERIALS.

THE quality and quantity of the raw materials contained on the Company's property have been thoroughly examined and tested, core borings and analyses having been made by eminent experts and chemists especially fitted for this work, and their reports show all the materials to be practically pure and almost entirely free from certain foreign substances, which as a rule, are found in sufficient quantities to render the materials worthless for the manufacture of a high grade Portland Cement. Our own engineers and experts have examined the entire property in detail and all report it to be a rare deposit of superior quality, unlimited in quantity, and perfectly adapted, as to location, for the business to be conducted successfully and profitably. Such raw materials are hard to find; so hard indeed that we believe it to be practically impossible to find in the west another such property containing the two raw materials of equal quality so admirably located. The discovery of the property will be more fully appreciated when it is understood that to-day over 70 per cent. of the Portland Cement produced in the United States from these materials is made in the Lehigh Valley region of Pennsylvania, entirely within a radius of fifteen miles of Allentown.

FUEL.

THE expense connected with the *manufacture* of Portland Cement is divided into several items, viz., getting out raw material and transporting it to the mill; reducing and preparing the raw material by grinding and mixing; burning the prepared mixture of raw materials to produce clinker; grinding the resultant clinker into an impalpable powder, which is the finished product, Portland Cement; packing and getting ready for shipment.

The most important and largest item in the expense of manufacturing this product, and that which amounts to more than all other items of

expense combined, is *fuel*. Fuel is necessary not only to furnish power for operating the mixing, grinding, conveying and all other machinery, but also for generating the immense amount of intense heat, which it is necessary to maintain in the furnaces for calcining the raw material after it has been properly prepared.

In this regard THE WESTERN STATES PORTLAND CEMENT COMPANY hold an unprecedented position in the Portland Cement manufacturing field. Situated as it is in the very heart of one of the greatest natural gas regions of the world, and itself possessing a large amount of the very choicest of this territory, and owning a practically inexhaustible supply of suitable natural gas already developed, this Company is given **absolutely free fuel**, of the most desirable character for furnishing all necessary power, heat for rotary furnaces, etc., and for every other purpose for which fuel is used.

In addition to this great supply of natural gas, the Company's shale lands being underlaid by great deposits of bituminous coal of the highest quality, further furnish an additional supply of most desirable free fuel easily accessible, which doubly insures to this Company the natural advantage of producing cement at this point, in its best form, at a cost price much less than it can be produced elsewhere; and renders this proposition one of the most desirable Portland Cement properties ever discovered.

ADVANTAGES OF LOCATION.

NEXT in importance to the abundant supply of good raw materials and fuel comes the question of location with reference to the markets at which it is proposed to deliver the product of the mills, as this factor alone enables manufacturers favorably located to survive competition, which would prove ruinous to others. In this respect Independence is an ideal location. Situated, as it is, near the geographical center of the Central West District, it is in the very heart of the producing region of the United States. Within this territory lie the majority of the fertile lands of this country west of the Mississippi River. This great central west section, rapidly growing and endowed with unlimited natural resources, is to-day, and must be for years to come, one of the best and most extensive markets in the country for Portland Cement. The rapid development of this region and the constantly increasing uses to which Portland Cement is being put, insures that for years to come the demand will be largely in excess of the local supply.

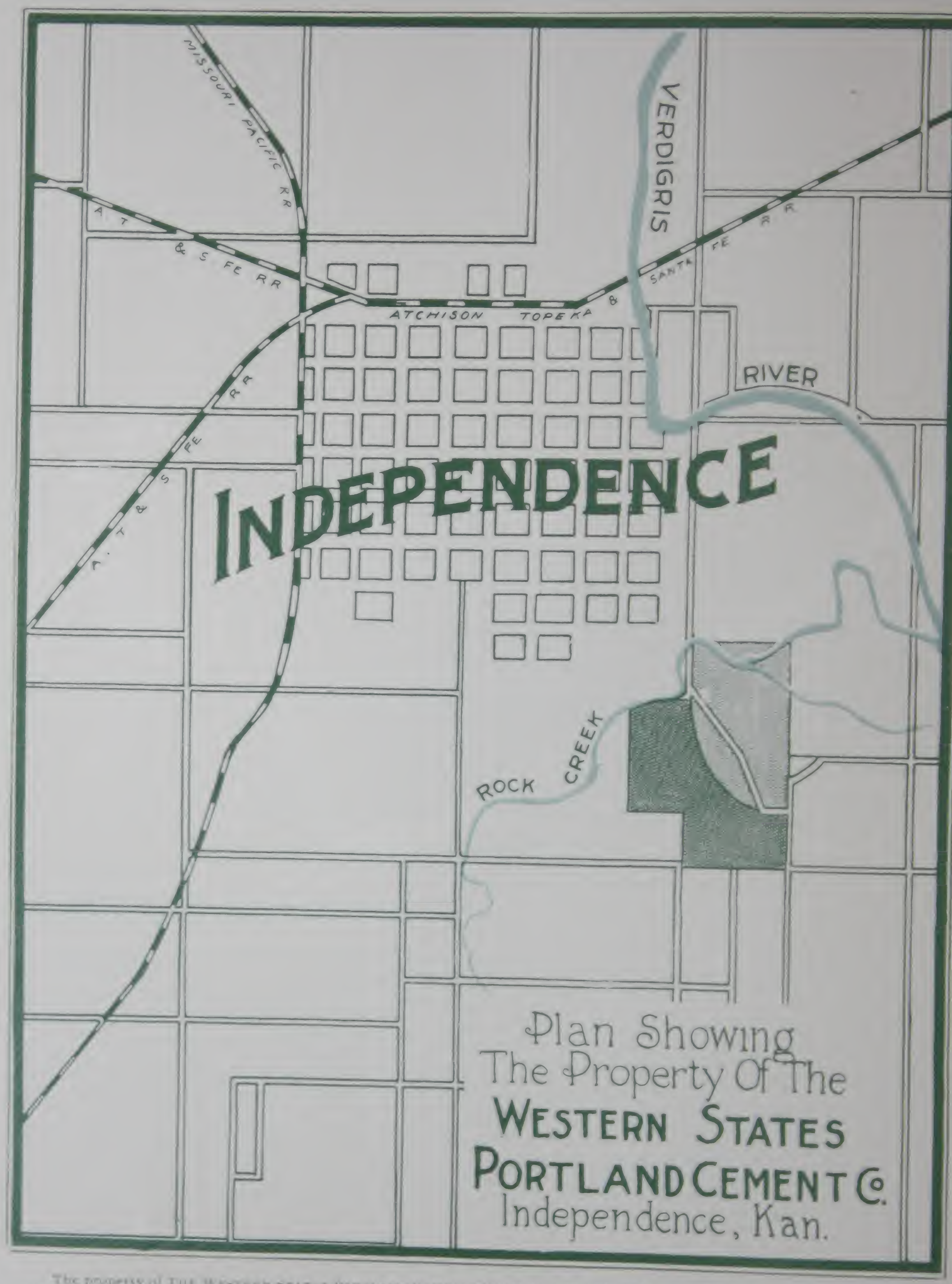
The ability to reach such markets often determines the destiny of manufacturing undertakings. The advantages of transportation cannot be

overestimated in an enterprise of this nature. Cement is a heavy substance and the cost of transporting it to markets is commonly a very considerable portion of the cost to the consumer. A mill which enjoys the advantage of low freight rates can sell its products at a profit at prices with which other mills paying higher rates cannot compete. Cheap transportation is such an important factor in an enterprise of this nature that it alone may add very materially to the profits on the investment.

Over 70 per cent. of the Portland Cement produced in the United States is made in the Lehigh regions of Pennsylvania. This eastern section together with the Michigan territory constitute the two great cement producing sections of the United States, leaving but a very small percentage of the output of this country to be made west of the Mississippi River. Kansas City, St. Louis, Denver, Omaha, Council Bluffs, Dallas, Galveston, Ft. Worth, Little Rock, Ft. Leavenworth, St. Joseph, Sedalia, Topeka, Des Moines, Sioux City, etc., the distributing points for this great middle west, are constantly demanding more cement, and their dealers are obliged to contract with eastern or foreign mills for large quantities annually, and to pay the high freight rates incident to the long haul by rail.

This Company, with its warehouses directly upon the tracks of two of the most important western trunk line railroads, the Missouri Pacific and the Atchison, Topeka and Santa Fe, is in direct communication with and has facilities for reaching the important cities and towns of the west and southwest, at a freight rate that renders successful competition in this territory from other factories less favorably located, who are burdened with the expense of fuel and compelled to pay much higher freight rates practically impossible. Situated as it is, at the county seat of Montgomery County, Kansas, which is one of the greatest railroad sections of the west, this Company will be further enabled at all times to move its products rapidly and will be independent of the congestion of traffic which at busy seasons frequently delays shipments. In this respect it is given so distinct and great an advantage over all other producers that it can without doubt control the cement trade of this particular territory and do so upon a highly profitable basis.

It is evident from the foregoing that, with its splendid deposits of raw materials, its abundance of free fuel, its proximity to great and increasing markets, and its remarkable transportation facilities, this Company has one of the finest cement properties on the continent. It would be difficult to name any respect in which the location at Independence could be improved upon. These natural advantages when developed by the corps of experienced men associated with this Company and handled by conservative and reliable men experienced in the commercial side of the Cement business should insure the success and stability of this enterprise.



The property of THE WESTERN STATES PORTLAND CEMENT COMPANY (consisting of [illegible] acres of Portland Cement rock and clay shale lands) is indicated by the shaded portion of the above map. The mill site is located near the bank of Rock creek which flows through the property. The cement rock is that portion of the property indicated by the dark shading and is immediately adjacent to and rises above the rock. Please note the exceptional clay shale is indicated by the light shading, while the transportation facilities of this Company to all points of the central west via both the two great western trunk line railroads—the Atchison, Topeka and Santa Fe Railroad and the Missouri Pacific Railroad. Add to these its many other advantages, including the abundance and exceptional purity of its raw materials, **ITS ABSOLUTE FREE FUEL**, its admirable location as to the markets, its improved factory and method of manufacturing, its experienced and competent management, and it clearly appears that THE WESTERN STATES PORTLAND CEMENT COMPANY is entitled to the conclusion that this is the very best Portland Cement proposition on the American continent.

From the above may the general location and unequalled shipping facilities of the Company be readily seen. It is located near the geographical center of one of the greatest producing regions of the world. Within this territory lie the majority of the cement mills of this country west of the Mississippi river. The section (the Mississippi valley) is to-day, and must be for years to come, one of the best and most extensive markets in the world for Portland Cement.

WESTERN STATES PORTLAND CEMENT CO.

FACTORY AND EQUIPMENT.

TO investors in the Portland Cement industry, the question of factory, its process, equipment, capacity, and quality of cement it will produce is of vital importance.

Poor, incompetent, or dishonest management can be promptly displaced, but it is a difficult, impractical and expensive undertaking to replace a poorly designed and cheaply constructed cement factory with a good one. To insure good earning power, a Portland Cement factory must first of all have capacity corresponding with the capital invested; it must be equipped with machinery that is certain to run and do its work from year to year without trouble and annoyance, and the process of manufacture must be one that will insure a uniform, high grade cement.

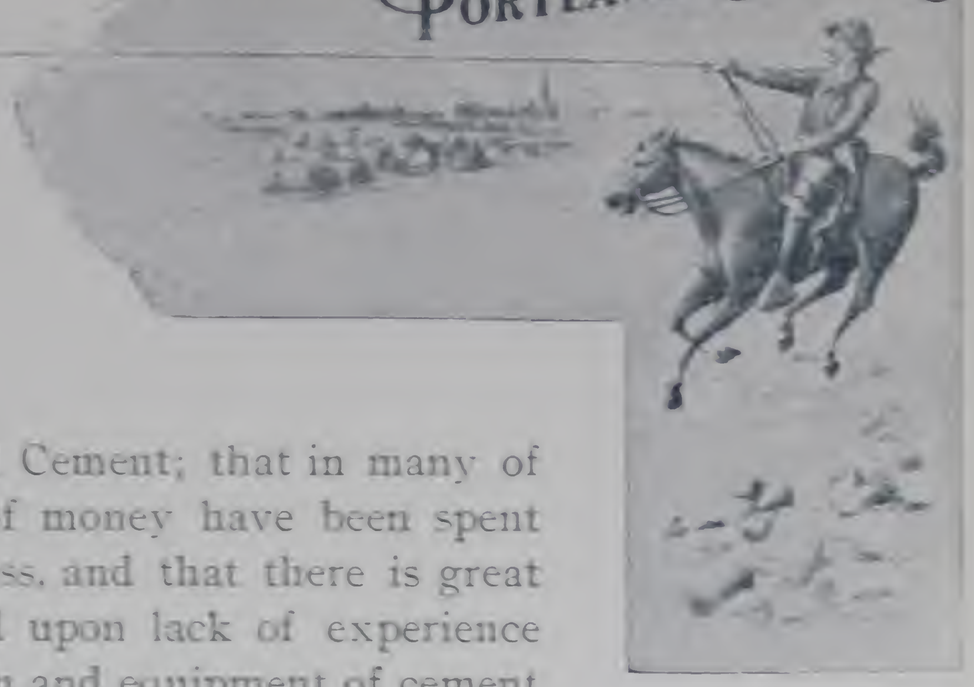
The history of this industry in both Europe and America, proves conclusively that the designers and builders of the most successful Portland Cement factories, together with the machinery therein installed, have gained their knowledge after years of practical experience in cement making. It is therefore of the utmost importance to prospective investors and those interested in the cement industry that the men upon whom this responsibility rests should be men of practical experience and unquestionable ability.

The factory to be built at Independence, Kansas, will be the product of the best mechanical and engineering skill in America, and having an estimated daily capacity of 2500 barrels. The power generated will be electrically distributed throughout the plant, which will be modern in every detail; the buildings will be convenient and equipped with the best and strongest types of machinery, all of which will be specially designed for this plant.

THE WESTERN STATES PORTLAND CEMENT COMPANY is especially fortunate in having associated with it a staff of the most practical cement engineers in this country, who have designed (including the machinery itself) and superintended the construction of many of the most modern and successful cement mills in North America; men who are identified with it in the cement business, and who are recognized leaders in cement manufacture.

Under these circumstances there is positively no guess work, no experimenting, and the most economical and perfect system of manufacture is insured; hence the best product.

It is a notable fact that the remarkable growth and healthy condition of the Portland Cement industry has offered great inducement to inexperienced engineers and promoters to engage in the business, who of necessity must obtain their experience slowly, and possibly at the expense of investors. It is well known to cement manufacturers that millions of dollars have been spent in Europe and America in learning and experimenting in the



economical manufacture of a high grade Portland Cement; that in many of the factories now in existence large amounts of money have been spent in processes and equipments which proved useless, and that there is great danger of possible misguided judgment founded upon lack of experience and knowledge in connection with the construction and equipment of cement mills.

In view of the foregoing, surely it is a satisfaction to know that this Company, as previously stated, has associated with it in this business a staff of engineers who are pioneers in cement manufacture and who are principals in designing cement mills, and to whom the world is largely indebted for the standard of perfection reached in the manufacture of high grade Portland Cement, their last and crowning efforts being the magnificent plants of the Peninsular Portland Cement Company, Jackson, Michigan; The National Portland Cement Company, Toronto, Ontario, the Southern States Portland Cement Company, Atlanta, Ga., and the International Portland Cement Company, Hull, Quebec, which are acknowledged by experts, both in Europe and America, to be the most modern and best equipped Portland Cement plants in the world.

ONE of the most frequent causes of failure of many manufacturing plants is, that after being designed and constructed they are turned over to the management of some person or persons who know nothing whatever regarding their operation.

With but little or no regard for their knowledge of or experience with cement factories or cement machinery, consulting mechanical engineers of reputation are sometimes employed to furnish plans and designs for cement plants; they having not only no particular interest in the work of construction, but also having no interest whatever in the operation of the plant, or the future success of the enterprise, after the plans and specifications have been furnished.

The management of the organization responsible for the erection of the magnificent factories illustrated in these pages, realizing the importance of trained supervision in their operation, as well as their construction, early associated with them in the business not only the experienced engineers, who have the general supervision of these plants after construction, as well as before, but also surrounded themselves with competent and experienced cement makers and heads of departments, all of whom are directly interested from the manufacturers' standpoint in the future success of the enterprise. It is therefore absolutely certain that every safeguard possible is provided that will insure not only the most improved plants and equipment, but also trained supervision in their operation.

THE COWHAM SYSTEM OF PORTLAND CEMENT MILLS.

Strongest organization for the manufacture and sale of high-grade Portland Cement in America.

TRAINED BUSINESS MANAGEMENT NECESSARY.

TO insure the success of large manufacturing undertakings, trained business management is of vital importance. The men upon whom this responsibility rests, should first of all be honest and trustworthy; besides they should have ability and experience in the business in which they are engaged. We present herewith a list of the Officers and Directors of the Cowham system of Portland Cement Mills, from whom we have a right to expect nothing but safe and conservative management in the administration of affairs:

W. F. COWHAM, Jackson, Michigan.
Sec'y and Gen'l Manager, Peninsular Portland Cement Company.
President, National Portland Cement Company, Limited.
President, Southern States Portland Cement Company.
President, International Portland Cement Company, Limited.

C. A. NEWCOMB, Detroit, Mich.
Prest., Newcomb-Endicott Company.
Prest., Peninsular Portland Cement Company.

H. B. CAMP, Akron, Ohio.
Stockholder Southern States Portland Cement Co.
President Akron Fire-Proof Construction Co.
President Barberton Pottery Co.
President Faultless Rubber Co.
President Camp Rubber Co.

A. F. MacLAREN, M. P., Stratford, Ont.
Prest., The A. F. MacLaren Imperial Cheese Co., Ltd.
Vice Prest., National Portland Cement Company.
Director, Southern States Portland Cement Co.
Vice-Pres., International Portland Cement Co., Ltd.

W. H. L. McCOURTIE, Jackson, Mich.
Proprietor Somerset Stock Farm.
Stockholder Cowham System Portland Cement Mills.

N. S. POTTER, Jackson, Mich.
Vice-President Jackson City Bank.
Treasurer Peninsular Portland Cement Co.
Director Southern States Portland Cement Co.
Treasurer Jackson Wagon Works.
Treasurer Jackson, Ann Arbor & Detroit R. R.

JACOB FOERSTER, Ypsilanti, Mich.
Sec'y-Treas., Foerster Brewing Company.
Director, Peninsular Portland Cement Co.

P. W. STANHOPE, Toronto, Ont.
Sec. and Gen. Mgr., Nat'l Portland Cement Co., Ltd.
Ex-Genl. Mgr., McCormick Harvesting Machine Co., Ontario Branch.
Sec'y, International Portland Cement Co., Ltd.

C. A. NEWCOMB, Jr., Detroit, Mich.
Member, Newcomb-Endicott Company.
Director, Peninsular Portland Cement Company.

W. C. ANDERSON, Detroit, Mich.
Prest., Anderson Carriage Company.
Director, Peninsular Portland Cement Company.

A. C. STICH, Independence, Kansas.
President Citizens' National Bank.
President The Coffeyville Vitrified Brick and Tile Co.
Vice-President Independence Gas Company.

GILBERT McKECKNIE, Durham, Ont.
Treasr., National Portland Cement Company.

DR. DAVID JAMIESON, M. P. P., Durham, Ont.
Prest., Durham Furniture Company.
Director, Southern States Portland Cement Co.
Treas., International Portland Cement Co., Ltd.

S. B. HUTCHINSON, Ypsilanti, Mich.
Manufacturer Veneers.
Stockholder Peninsular Portland Cement Co.
Stockholder Hay & Todd (Ypsilanti Underwear).
Vice-President Sperry & Hutchinson, N. Y.

DARWIN C. GRIFFIN, Ypsilanti, Mich.
Director First National Bank.
Director, Peninsular Portland Cement Company.

JOHN W. SHOVE, Jackson, Mich.
Stockholder Peninsular Portland Cement Co.
Director Jackson Sand-Brick Co.

J. S. IRVIN, Toronto, Ont.
Director, Peninsular Portland Cement Company.
Director, Southern States Portland Cement Co.
Director, International Portland Cement Co., Ltd.

JOHN W. BOARDMAN, Atlanta, Ga.
Treasr., Southern States Portland Cement Co.
Prop., Jackson County Stock Farm.

HUGH F. VAN DEVENTER, Knoxville, Tenn.
Prest., Georgia Slate Company.
Sec'y, Southern States Portland Cement Company.

W. H. NIBLICK, Decatur, Ind.
President Old Adams County Bank, Decatur, Ind.
Vice President Peninsular Portland Cement Co.
Secretary Decatur Egg Case Co.
Sec'y-Treas., Paragould & Memphis R. R.

BARLOW CUMBERLAND, Toronto, Ont.
Vice Prest., Niagara Navigation Company.
Director, National Portland Cement Co., Ltd.

FRANK HAWKINS, Atlanta, Ga.
Prest., Third National Bank.
Vice Prest., Southern States Portland Cement Co.

W. W. HAWLEY, Huntington, Indiana.
Director Huntington County Bank.
Director Peninsular Portland Cement Co.
Director Western Lime Company.
Vice-President Pacific Starch Company.

F. E. PALMER, Jackson, Mich.
Ex-Mayor of the City of Jackson.
Manager, McCormick Harvesting Machine Co.
Director, Peninsular Portland Cement Co.

PROFITS.

CAREFUL investigation of the Portland Cement industries in all countries, proves conclusively that it has been universally a profitable and staple business. The splendid dividends made by some of the present crude and poorly equipped mills in this country are well known. Germany, a cement exporting country, with most of its product still manufactured under the old crude and extravagant system, laboring also under the disadvantages of sharp competition, heavy export shipping rates, payment of large duties and tariffs, has always made handsome dividends on its cement properties, as is shown by the following table, taken from the authentic report of the *Thonindustrie-Zeitung* of Berlin, Germany, relative to dividends paid, and the market price of stock of some of the principal and best known German Portland Cement plants:

KURSTABELLE.

AKTIEN.

NAME	DIVIDENDE		GIESCH. JAHR	KURS	
				1900	
	1898	1899		27-8	28-8
Adler, Deutsche Portl.-Cem.-Fabr. conv.	14	25	1-1	170.00 bzG	171.00 bzG
Alsen'sche Portland-Cement-Fabriken	21	25	1-1	214.00 bzG	214.00 bz
Deutsche Steinzeugwarenfabrik	13	17	1-1	280.50 B	280.50 B
Portland-Cement-Fabrik Hemmoor	15	15	1-1	129.80 bz	129.40 B
Porzellan-Fabrik Kahla	24	25	1-1	314.00 G	312.00 bzG
Lothr. Cementwerke	12	14	1-1	169.75 G	167.75 G
Nauheim, Fabrik saurefester Produkte	15	15	1-1	150.60 G	150.30 bz
Porzellanfabrik Konigsdt	14	14	1-7	192.75 G	191.00 bzG
Stettiner Chamotte-Fabrik (Didier)	25	30	1-1	334.00 bzG	331.25 bzG
Vorwohler Portl.-Cem.	18	18	1-1	179.00 G	174.10 bzG
Westfalia, Portl.-Cem.-Fabr. i. Beckum	33	25	1-1	189.00 bz	185.00 bzG
Schlesische A.-G. f. Portl.-Cementfabr.	17	17	1-1	157.50 G	157.00 B
Portland Cementfabrik Gossnitz	15	20	1-10	not reported	not reported
Ziegelei Augsburg i. Augsburg	10	15	1-12	325.00 G	330.00 bz
Porzellan-Fabrik Kahla i. Kahla	24	25	1-1	318.00 bz	not reported
Porzellanfabrik Kloster-Gemeinschaine	17	21½	1-1	not reported	not reported
Sachs. Ofen- u. Chamt.-F. (R. Teichert)	24	25	1-1	not reported	not reported
Hannoversche Portl.-Cem.-Fabr. A. G.	20	25	1-1	170.00 B	170.00 B
Portland-Cementfabrik vorm. Heyn Gebr. A.-G., i. Lueneburg	16	18	1-1	147.00 bB	145.00 bB
Vorwohler Portl.-Cem.-F. Planck & Co.	18	18	1-1	180.00 B	180.00 B
Actien-Ziegelei Munchen	12	15	1-1	885.00 G	not reported
Mechanische Barkstein-Fabrik	16	10	1-1	not reported	850.00 G
Cementfabr. Groschowitz	17	17½	not rep	not reported	not reported
Stettin-Bredower Portland-Cementfabr.	12½	14	1-1	140.00 bz	140.00 G
Wirkingsche Portl. C.-F. Recklinghaus.	16	15	1-1	not reported	not reported
Schwarzauer Cem.-Fabr.	45	40	1-1	320.00 B	320.00 B
Glockoserok.-Ges.	40	not rep	1-1	300.00 B	300.00 B

The United States has also universally good paying cement mills as will be seen from the following articles of the press of this country:

EXTRACTS FROM THE PRESS.

There never was a brighter industrial future than that now before American makers of Portland Cement.—*City Engineer Ericson, Chicago, Ill.*

The American Cement Company cancelled on October 1st, an additional $35,000 of its 5 per cent. bonds.—*Cement and Engineering News, November, 1902.*

The American Cement Company has declared the regular semi-annual dividend of three per cent. and an extra dividend of one per cent. payable on July 21st. Books close on July 10th, and re-opened on July 22nd.—*Cement, July, 1902.*

LARGE EARNINGS—The gross business of the American Cement Company at Philadelphia, for the four months ending March 31st, shows an increase of 18 per cent. over the corresponding period of last year. The balance sheet showed a surplus of quick assets over current liabilities of $243,000.—*Cement and Engineering News, May, 1900.*

A GOOD BUSINESS—The fire in the plant of Glens Falls Portland Cement Co. on Sunday caused a loss of $300,000 and threw 90 men out of employment. The Glens Falls Portland Cement Co. was organized 1875, and incorporated under the laws of the State of New York. The company has been doing a very profitable business, and last week its stock sold at $170.00 for $100.00 shares.—*Decatur Evening Journal, April, 1900.*

It is generally conceded that securities based on the Portland Cement industry have a very promising future in view of the broadening field for operation of the companies. Stock of the American Cement Company, it seems to many, is a very attractive purchase around current quotations. But very little of this issue, however, comes on the market due to the fact that it is closely held by investors.—*Stockholder, Philadelphia, Pa., February, 1900.*

SALE OF BIG CEMENT PLANT—The biggest cement deal in the history of this industry was consummated to-day in the sale of the plant and property of The Cuplay Cement Company. The concern will shortly pass into the hands of the new owners, who are Philadelphia and London capitalists. The syndicate purchased all the stock of the company. The par value of the latter is $50.00 per share, and on this the company has for some years been paying an annual dividend of 32 per cent.—*Philadelphia (Pa.) Times, May, 1900.*

The directors of the Sandusky Portland Cement Company on April 1, 1902, declared a dividend of 6% on the preferred stock, payable 1½% April 5, July 1, October 1, and December 31. In June, 1902, they also declared a dividend of 1% on the common stock payable monthly on the 10th of each month from June 10 to December 10, 1902. It is presumed that further dividends will be subject to the action of the directors.—*Cleveland, Ohio, Commercial Bulletin.*

The Portland Cement age is just beginning, and those interested have a great era before them in the manufacture of this material that now has such a wonderfully increasing demand.—*Cement and Engineering News, January, 1902.*

The Iola Portland Cement Company has declared its 3½ per cent. semi-annual dividend on Preferred Stock ($1,500,000); 1¼ per cent. payable January 1st, 1902, and 1¼ per cent. April 1st. The Directors ordered an expenditure of $70,000 for extensions and improvements of the plant.—*Cement and Engineering News, January, 1902.*

IOLA PORTLAND CEMENT CO. DOING A GOOD BUSINESS.—Detroiters interested in the Iola Portland Cement Co. are congratulating themselves on the showing made by the Company. Its semi-annual dividend of 3½ per cent will be declared before January 1, and it is stated that after that a dividend will be paid on the common stock. "It is surprising," said a gentleman connected with the Company yesterday, "to note the increased demand for cement. The factories of the country cannot begin to keep up with the demand, and there is not one big concern making a first-class article that is storing any of its stock. The demand is no sudden fad, but a legitimate growth caused by the increased use of cement in all building lines and for underground work."—*Detroit Tribune, November 26, 1902.*

IOLA PORTLAND CEMENT DECLARES A DIVIDEND.—The directors of the Iola Portland Cement Co. at a meeting held in Chicago declared a dividend of one per cent. a month on the common stock, the first payment to be made in July. The stock of the Company is largely held in Detroit, and has been extremely active recently in anticipation of a dividend on the common. The plant of the Company is located at Iola, Ks., and though the officers are very reticent as to the amount of business being done it is stated that the profits are now exceeding $100,000 a month.—*Free Press, June 9, 1903.*

BIG PROFIT IN CEMENT.—The Iola Portland Cement Company at Iola, Kansas, in which many Michigan people are heavily interested, is said to be the biggest money-maker of all the cement companies in the world, its net earnings being approximately $100,000 a month. This is partly owing to the fact that natural gas for fuel is found on its property. A Detroit banker figures the earning power of the Company as follows. "The plant has a capacity of 3,000 barrels a day, or 90,000 barrels a month, but to be conservative we will take off 10,000 barrels for possible shutdowns. This would leave 80,000 barrels. The selling price is $1.85 a barrel and the cost of production 53 cents a barrel, leaving a profit of $1.32 per barrel, or net earnings of $105,600 a month, and for the year $1,267,200. It takes $105,000 a year to pay the 7 per cent. dividend on the preferred stock, leaving $1,162,200 for common dividends, or 39 4-100 per cent. If there is any other cement company in the world making such profits I never heard of it. The most singular thing is the comparative earning power of the common and preferred stock. The preferred is only entitled to 7 per cent., hence, as a dividend earner the common beats it out of sight."—*Detroit Journal, June 10, 1903.*

WOLVERINE PORTLAND CEMENT COMPANY MAKING MONEY—EARNED OVER $350,000.00 LAST YEAR.—The Wolverine Portland Cement Co. is in a flourishing condition, according to the reports of insiders. The Company has spent $50,000 in the improvement of its plants during the past year. "It has not only done this," said John T. Holmes yesterday, "but it will soon declare a dividend of between 8 and 10 per cent. It earned over $350,000 and will have a nice surplus after the dividend is paid."—*Detroit Tribune, November 26, 1902.*

A PROSPEROUS YEAR.—The annual meeting of the Wolverine Cement Company was held at Coldwater Tuesday. During the fiscal year of the Company, March 1, 1902, to February 28, 1903, a total of 452,359 barrels of cement were manufactured, of which 426,907 barrels, or 3,000 carloads were shipped, leaving on hand a balance of 25,452 barrels, in the shape of clinker and finished product. To burn this amount of cement, **80,000 tons of coal were used, which required the use of 2,677 cars, and cost the Company $192,000, an average of $2.40 per ton.** The outlook for business in 1903 is brighter than ever before, and the Company looks forward to a very prosperous year. —*The National Cement Review, April, 1903.*

OMEGA CEMENT CO.—At the annual meeting of The Omega Cement Company, which is located on the line of the Fort Wayne and Jackson Railroad, about twenty miles south of this city, a splendid showing was made for last year. An 8 per cent. dividend was declared, payable July 1st, and $40,000 was added to the surplus fund. With stock in store and orders already on the books, the Secretary figures upon an additional $100,000 in net profit during the balance of the year. It is asserted that every Portland cement factory in Michigan has already contracted for its output for a year to come at a large advance over the prices that prevailed last year.—*Jackson Evening Press, April 21, 1903.*

At a meeting of the Board of Directors of the Peninsular Portland Cement Company, of Jackson, Michigan, on December 23rd, the regular 7% dividend on Preferred Stock was declared, payable on or before January 1st, 1903. The Company has enjoyed a very prosperous career, and are now doing an enormous business. Although the factory has been in constant operation both day and night since its completion, the Company has been utterly unable to supply the unsolicited orders for its product—which has made it necessary for a further increase in the capacity of the plant. The Peninsular Company enjoys the distinction of having the most modern cement mill in existence.—*Michigan Investor, Detroit, Jan. 1st, 1903.*

BOOM IN CEMENT BUSINESS.— * * * The holders of the stock of the parent company of the Cowham group, The Peninsular Portland Cement Company of this city, are congratulating themselves these days, as the dividend of seven per cent., declared January 1st last, has been followed by a notice of another dividend of seven per cent., to be paid July 1st. The people of this city who invested in cement stock in the days when the business was in absolute infancy and wholly an experiment, are feeling quite pleasant nowadays, as every mill of the Cowham system in operation not only has contracts for its output for a year in advance, but has been turning down all orders for several weeks back, and the reputation of Mr. Cowham as a prophet has not suffered in consequence of the fulfillment of his predictions.—*Jackson Morning Patriot, May 5, 1903.*

When it is understood that many of the factories above referred to are unfavorably located, are hauling their raw materials via rail many miles to the factory, are not equipped with the latest improved methods of manufacture, are burdened with that greatest of all items of expense—fuel—and are also laboring under other serious disadvantages which will not be encountered by THE WESTERN STATES PORTLAND CEMENT COMPANY, it must certainly appear even to the most criticising and conservative business man that the cost of manufacture by this Company should be greatly reduced, and that it should be able to lay its product down at the market at a total cost and expense that cannot be duplicated by any other factory in the country.

Taking into consideration simply the advantageous location of its raw materials, and estimating the amount actually saved by its improved system of manufacture (so perfected that the raw materials will actually pass through the entire process of making without the agency of human hands), its absolute free fuel, its cheap and ready means of transportation to an ever-growing and unsupplied market, and its competent and experienced management, it is impossible to figure the profits of THE WESTERN STATES

PORTLAND CEMENT COMPANY even as low as the highest indicated by any of the factories above mentioned. From the foregoing, and from the most conservative estimates based on the experience of the American cement industry, this Company is entitled to the conclusion that the earnings of its improved plant at Independence, Kansas, should be fully equal, if not far in excess, of any other mill of like capacity in the world.

With its many natural and indestructible advantages, plant of the very best possible mechanical equipment, and competent business management, THE WESTERN STATES PORTLAND CEMENT COMPANY is deservedly commanding the attention of the thoughtful, conservative business man and investor.

There is to-day no line of investment that promises larger, more certain, or more permanent returns on capital invested, nor one where the absence of all speculative features is more marked than in connection with the proper and economical production of a high grade Portland Cement.

THIS COMPANY'S OPPORTUNITY.

THE WESTERN STATES PORTLAND CEMENT COMPANY, in embarking upon this enterprise to manufacture a high-grade Portland Cement to supply this growing demand, has before it the brightest prospects.

There is no element of speculation entering into this project. The natural deposits at Independence, Kansas, are absolutely determined both in quality and extent. Soundings, core borings and analyses have told the story unmistakably.

Fuel—the most important and greatest of all items of expense—*is absolutely free.*

The location cannot be excelled.

The markets are extensive and close at hand.

By reason of the superior quality of cement which it will produce, this Company will be able to meet the most severe requirements of the railroad, municipal and government engineers, and on account of the large capacity of its mills, it will be further enabled to take on the large contracts, which are both desirable and profitable.

The transportation facilities are the best.

The factory and machinery will be designed, installed, and operated by men of long practical experience in cement making.

This Company is also extremely fortunate in having that no less important factor of success, the competent and expert business management of men thoroughly familiar with every detail of the cement business.

There is no prospecting or experimenting to be done; no chance to be taken.

The success of the enterprise is assured.

ORGANIZATION AND FINANCIAL PLAN.

THIS Company is organized in connection with and for the development of the valuable deposits, described in the foregoing, located near Independence, Kansas, and it is the purpose of the Company to immediately erect and put into operation at this point the best, the most complete, and one of the largest Portland Cement mills in the country.

The basis of organization is such that $1,500,000 of 7% Preferred Stock and $2,000,000 of Common Stock is the total capitalization of the Company.

All the stock of the Company is fully paid, and non-assessable.

The Company will issue its 7% Preferred Stock as ordered from time to time by the Board of Directors.

The Preferred Stock as provided in the certificate, "is entitled to a fixed dividend of seven per cent. per annum from July 1st, 1904, or subsequent date of issue, payable annually and cumulative until said shares of stock are called for redemption: the whole or any part thereof being redeemable by said Company at its par value with unpaid dividends at any time on or after July 1st, 1909, said redemption to be made at the time fixed for payment of any annual dividend. The preference as to stock and dividends extends to the assets as well as to the earnings of said Company.

"The voting power of the Preferred shall equal that of the Common Stock, share for share."

With each share of Preferred Stock one-half share of Common Stock will be issued; therefore whenever the Preferred Stock is retired the subscribers thereto will have received their principal, plus 7% annual dividends, and still hold Common Stock to represent one-half their original investment.

Dividends on Common shares will be declared as warranted by the earnings, after making required provisions for Preferred shares, and provision for such extensions of mills and business as may, in the judgment of the Board of Directors, be of advantage.

The proceeds of the Preferred Stock is estimated to be ample and sufficient to cover all expenses of constructing and equipping, with all necessary appliances, cement mills with a daily capacity of 2500 barrels, and also to provide a working capital.

The management will be under the control of experienced cement manufacturers and men well known in financial and business circles, whose connection with the enterprise establishes its position and assures its success.

LABORATORY

PENINSULAR PORTLAND CEMENT COMPANY,
CEMENT CITY, MICH.

THE WESTERN STATES PORTLAND CEMENT COMPANY,
Independence, Kansas.

Gentlemen—We submit the following report of analysis and tests made by us from the limestone rock, and clay shale furnished us from the property of your Company. An average of numerous samples of these materials showed the following:

ANALYSIS OF LIME STONE.		ANALYSIS OF CLAY SHALE.	
Calcium Carbonate	97.42	Silicia	58.19
Ferric Oxide	0.30	Aluminum Oxide	23.05
Aluminum Oxide	0.68	Ferric Oxide	8.05
Magnesia Carbonate	0.52	Calcium Oxide	1.67
Silica	0.94	Magnesium Oxide	1.43
Sulphuric Acid	0.14	Loss by Ignition	6.95
	100 00	Total	99.34

These constituents, when properly combined, would make an easy burning, strong and sound cement, equal, if not superior to that of the best Portland Cement now on the market. Your limestone is rich in carbonate of lime, and carries small percentages of silica, iron oxide and alumina, all of which enters into the economic manufacture of Portland Cement. The magnesia and sulphuric acid, so often found in excess in limestone, is found in very small proportions. One remarkable feature of the limestone is that there is no appreciable amount of organic matter to burn out or hinder in its reduction. The limestone is especially valuable, not only as shown by analysis, but by reason of its texture, being brittle and chalkey, an easy proposition to pulverize. The grinding would be very much reduced in a mill using this material.

Referring to the above analysis of materials we beg to say that we consider the samples submitted as representing bodies of material which are very regular in character as well as high in quality; in fact, it is unusual in our experience to find such high grade raw materials maintaining such regularity in composition throughout.

These materials were further tested by mixing them according to our formula, and Portland Cement was made from the same, which many tests proved to be entirely satisfactory, and showed that from these raw materials a cement should be manufactured equal in quality to any produced in the world.

With this report we send you a sample of cement and a "briquette" of same made in our laboratory from your materials and by our formula. "Pats" and "briquettes" from this cement, when subjected to boiling water for several hours do not shrink or crack, but set quickly and harden slowly.

The finished cement also has that very desirable tint or color so much sought for by cement masons.

We therefore conclude that your raw materials possess all the essential good qualities, and none of the poor ones, for the manufacture of the highest grade of Portland Cement.

Yours very truly,

PENINSULAR PORTLAND CEMENT COMPANY.

By H. W. BERGER, *Chemist*

COWHAM SYSTEM OF MILLS CORE-BORING MACHINE IN OPERATION.

Securing samples of raw material at various depths, for chemical analysis. By this method the extent and uniform quality of the raw materials are absolutely determined.

A RARE DEPOSIT.

From a photograph, giving but a faint idea of the immense deposit of Portland Cement rock on the property of THE WESTERN STATES PORTLAND CEMENT COMPANY, Independence, Kansas. Portland Cement made from this material, given all the severest tests, proved to be of the highest quality.

Cut from a photograph giving a small sectional view of the immense clay shale mound of THE WESTERN STATES PORTLAND CEMENT COMPANY. Clay shale is composed chiefly of decomposed orthoclase (feldspar), whose composition is aluminum silicate. To this is added other decomposed rocks, which taken together forms what is generally called clay. The nature and composition of the clay shale depends on the amount and kind of decomposed rocks contained in them. Portland Cement requires in its successful manufacture a clay shale having a certain chemical composition to go with the limestone, viz., high in "soluble" silica, certain relative percentages of iron oxide and alumina, low in magnesia and sulphuric acid, and free from free silica or sand. In all these particulars the Company's immense deposit of clay shale is admirably suited to the cement rock for the manufacture of a high grade Portland Cement. The dark section shown in the lower right hand corner of this cut, is the outcropping of a vein of bituminous coal which underlays the shale lands and is easily accessible since the shale will be stripped from above it. The shale deposit continues beneath this coal to an unknown depth.

This cut is from a photograph taken on the Company's property near the top of the clay shale ridge, which overlooks the cement rock deposit, giving a bird's-eye view of the Company's raw materials and also showing the City of Independence in the distance. The mill site is located near the ravine, as indicated by the X near the center of this cut. Photographs of cement rock shown on pages 30 and 33 were taken in this ravine, and the light ledges, shown in the above valley, are outcroppings of this immense deposit of rock. The X in the left hand upper corner of cut indicates the outcropping of the coal vein which underlays the clay shale deposit and is the location where photographs of clay shale and coal shown on page 31, were taken. These materials, as shown above, are immediately adjacent to each other and are all easily accessible and can be conveyed to the factory cheaply and conveniently.

Photographic views of the immense Portland Cement Rock Deposit on the property of
The Western States Portland Cement Company, Independence, Kansas.

This is a reproduction of a photograph showing the chief engineer and some of the directors and stockholders of THE WESTERN STATES PORTLAND CEMENT COMPANY inspecting the great Independence, Kansas, gas fields. This is one of the greatest natural gas regions of the world, and special attention is directed to the permanency and reliability of the gas supply. Several huge smelting works, glass factories, brick plants, etc., have been successfully operated for many years in this vicinity, depending entirely, and without break, in their operations, upon this supply of gas. THE WESTERN STATES PORTLAND CEMENT COMPANY owns or controls 1,383 acres of the choicest of this gas territory (1,200 acres of which is proven gas land)—a practically inexhaustible supply of most desirable FREE FUEL. It possesses a single gas well, located on this territory, which is capable of producing over 14,000,000 cubic feet of gas daily, and which regains its rock pressure almost immediately. It has been satisfactorily demonstrated, beyond any question, that the natural gas property of this Company will far more than meet its every requirement in the various departments of the manufacture of Portland Cement for generations to come.

BIRD'S-EYE VIEW OF THE PROPOSED PLANT OF THE WESTERN STATES PORTLAND CEMENT CO., INDEPENDENCE, KANSAS.

(COWHAM SYSTEM)

Every improvement that American genius can devise will be incorporated in these Works. The machinery designed and installed by master hands, electrically driven (power generated by absolute free fuel—natural gas in abundance) will carry the raw materials through the entire process of manufacture without the agency of human hands.

BIRD'S-EYE VIEW OF THE GREAT WORKS OF THE PENINSULAR PORTLAND CEMENT COMPANY, CEMENT CITY, MICHIGAN.

The parent factory of the Cowham system of Portland Cement mills—strongest organization for the manufacture and sale of high-grade Portland Cement in America. The record of this plant is unparalleled in the history of the Portland Cement industry.

PENINSULAR

WORLD'S GREATEST CEMENT FACTORY.

(From the Daily Patriot, Jackson, Mich., December 28, 1902.)

THE plant of the Peninsular Portland Cement Co., of this city, is recognized to be the most modern and best equipped Portland Cement factory in the world, and the results of its operations have more than justified every prediction of its designers and builders. From the day when the wheels were first put in motion, the mill has not shut down one minute while the raw material, by this latest system of cement making has, day and night, been taken from its natural resting place and carried through the intricate process of cement making until it fell into the bins in the form of commercial cement, all without the agency of human hands. Days, nights and Sundays it has run to its fullest capacity, veritably coining dollars out of raw materials which were long supposed to be worse than useless, and it has been utterly unable to fill the orders which have come to it unsolicited.

The fact that not a sack of this cement, to say nothing of a carload, has ever been rejected or returned, and that the Cement City mill, with its superior process of manufacture, is utterly unable to fill its orders, demonstrates better than any words could the success of the project which is of so much importance to this city. It is a monument to the excellent judgment of the gentlemen who originated this enterprise.

The Portland Cement industry has passed the experimental stages, and the great success of the enterprise at Cement City, demonstrates beyond question that the industry should be founded on strong financial lines, and that the selection of raw materials, and the designing, building and operating of Portland Cement factories should be intrusted *only* to men of unquestionable ability, and practical experience in cement making.

Government Test Peninsular Portland Cement.

ORDNANCE DEPARTMENT, U. S. A.

Report of Mechanical Tests Made with U. S. Testing Machine (Capacity [illegible] Pounds), at Watertown Arsenal, Mass., Dec. 16, 1901, for Investigative Purposes.

Tensile and Compressive Tests and Determination of Fineness and Specific Gravity. Composition, sand

Tensile Test—Five Samples of a Kind Tested.

Amount of Water Used	Age in		Tensile Strength per Square Inch.		
	Air	Water	Maximum	Minimum	Mean
Per Cent	Days	Days	Pounds	Pounds	Pounds
20	1		251	177	196
20	7		363	301	334
20	28		541	457	506
20	1	6	852	668	780
20	1	27	952	857	906
22	1		209	166	189
22	7		462	313	398
22	28		518	441	457
22	1	6	724	568	666
22	1	27	1,060	752	886
25	1		223	148	190
25	7		475	391	410
25	28		542	493	450
25	1	6	568	451	509
25	1	27	803	698	748

Fineness.

Retained on 96 x 100 sieve ..... 4.95 per cent.
Passed 96 x 100 sieve and retained on 174 x 182 bolting cloth ..... 19.75 " "
Passed 174 x 182 bolting cloth, obtained by difference ..... 75.30 " "

Specific Gravity.

At [illegible] from the barrel 3.20
After mixing with 20 per cent. of water, setting 7 days in air, and heating to a constant weight at 110 deg. C. 2.81

Compressive Tests—Five Samples of a Kind Tested.

Amount of Water Used	Age in		Compressive Strength per Square Inch.		
	Air	Water	Maximum	Minimum	Mean
Per Cent	Days	Days	Pounds	Pounds	Pounds
20	1		800	654	717
20	7		5,430	4,710	5,080
20	28		6,370	5,460	5,990
20	1	6	4,790	3,770	4,350
20	1	27	8,080	6,750	7,570
22	1		670	530	595
22	7		5,860	5,060	5,460
22	28		6,510	5,630	6,180
22	1	6	6,370	5,230	5,780
22	1	27	9,160	7,860	8,570
25	1		430	348	430
25	7		5,610	5,160	5,410
25	28		5,550	4,850	5,130
25	1	6	5,440	5,360	5,860
25	1	27	8,140	6,110	7,380

Cement and Crushed Marble Quartz—Compressive Tests.

Composition: Sand: Water: 18.8 Per Cent. of Cement.

Age in			Standard Compression	Compressive strength per Square Inch.		
Air	Water	Air		Maximum	Minimum	Mean
Days	Days	Days	Inches	Pounds	Pounds	Pounds
1			2" x 2" x 2"	5,080	4,080	4,570
1	6		do	6,480	5,710	6,260
7			do	7,300	5,580	6,140
7	28		do	10,830	7,100	8,870
28			do	6,370	5,780	6,080
1	27		do	9,880	9,080	9,560
28			2" x 2" x 4"	8,440	6,490	8,050
1	27	6	do	13,090	12,180	12,550
28			2" x 2" x 2"	8,330	8,370	8,370
28	27	6	do	11,750	11,040	11,480
7			2" x 2" x 2"	7,080	7,050	7,595
7	21	6	do	10,710	9,610	10,160

Composition: Cement 1: Sand 1: Water, 18.8 per cent. of Cement.

1			2" x 2" x 2"	3,040	2,740	2,890
1	6		do	3,530	3,040	3,280
28			do	3,740	3,160	3,490

Age. in Air.	Age. in Water.	Age. in Air.	Nominal Dimensions.	Compressive Strength per Square Inch. Maximum.	Minimum.	Mean.
Days.	Days.	Days.		Pounds.	Pounds.	Pounds.
1	29		2″x 2″x 2″	5,450	4,370	4,680
92			do	3,820	3,000	3,410
94			3″x 3″x 2″	5,680	4,960	5,320
1	91	2	do	7,960	7,180	7,570
94			4″x 4″x 4″	5,130	4,920	5,025
1	91	2	do	8,340	7,450	7,895
96			6″x 6″x 4″	5,800	5,750	5,775
1	91	4	do	8,520	8,360	8,440
Composition, Cement 1, Sand 2; Water, 48.1 per cent. of Cement.						
7			2″x 2″x 2 ″	1,550	1,250	1 370
1	6		do	1,840	1,300	1,440
30			do	1,640	1,320	1,490
1	29		do	2,970	2,340	2,750
93			3″x 3″x 3″	2,790	2,430	2,635
1	90	2	do	5,500	4,420	4,990
95			4″x 4″x 4″	2,850	2,190	2,520
1	90	4	do	5,100	4,740	4,920
95			6 ″x6″x 6″	3,060	3,000	3,030
1	90	4	do	4,580	4,180	4,380

Composition, Cement 1, Sand 3; Water, 68 per cent. of Cement.

Age. in Air.	Age. in Water.	Age. in Air.	Nominal Dimensions.	Compressive Strength per Square Inch. Maximum.	Minimum.	Mean.
Days.	Days.	Days.		Pounds.	Pounds.	Pounds.
101			3″x 3″x 3″	1,800	1,160	1 510
1	96	4	do	3,330	2,900	3,140
101			4″x 4″x 4″	1,690	1,660	1,675
1	96	4	do	3,240	3,170	3,205
101			6″x 6″x 6″	1,760	1,750	1,755
1	96	4	do	3,070	2,880	2,975
Composition, Cement 1, Sand 4; Water 87 per cent. of Cement.						
7			2″x 2″x 2″	560	425	473
1	6		do	590	526	557
30			do	733	556	656
1	29		do	1,040	873	950
100			3″x 3″x 3″	1,250	832	1,030
1	95	4	do	2,210	1,840	1,970
100			4″x 4″x 4″	1,200	1,160	1,180
1	95	4	do	2,070	1,970	2,020
100			6x″ 6″x 6″	1,170	1,140	1,155
1	95	4	do	1,530	1,450	1,490

Compression Tests of Cement and Cement Mortar Prisms, showing elastic properties and compressive strength.
Nominal Dimensions, 2″x 4″x 6″.
Gauged Length, 20″.
Weight per cubic foot of prisms, which were set in water include the water held in absorptionby them.

Composition. Cement	Sand.	Water.	Weight per Cubic Foot.	Age in Air. Mos.	Age in Air. Days.	Age in Water. Mos.	Age in Water. Days.	Modulus of Elasticity. Betw'n Loads per sq. in. of 500 and 2,000.	Modulus of Elasticity. At Highest Stress Observed.	Permanent sets after loads per sq. in. of 600	1,000	2,000	Compressive Strength per Square Inch
		Per Ct.	Lbs.	Mos.	Days.	Mos.	Days.	Pounds.	Pounds.	Inch.	Inch.	Inch.	Pounds
Neat		22.2	135.3	2	13			3,571,000	3,125,000	0.	.0001	.0005	6,710
"		27.5	138.0		1	2	14	3,846,000	3,509,000	.0001	.0001	.0005	6,720
1	1	32.5	133.4	2	13			2,941,000	2,439,000	0.	.0001	.0013	4,200
1	1	31.8	139.5		1	2	12	4,225,000	3,333,000	.0001	.0002	.0006	6,890
1	2	48.1	125.4	2	21			1,974,000		.0005	.0011	.0041	2,420
1	2	46.4	136.1		1	2	13	3,093,000	2,198,000	0.	.0001	.0008	3,920
1	3	68 0	118.8	2	20				1,389,000	.0005	.0020		1,510
1	3	58.3	130.7		1	2	11		1,695,000	.0004	0009	.0029	2,570
1	4	87.0	113.4	2	21				1,212,000	.0015			900
1	4	80.0	128.4		1	2	11		893,000	.0009	.0065		1,060

CORRECT,
J. E. HOWARD.

JOHN G. BUTLER,
Lt. Col., Ord. Dept., U. S. A.,
Commanding.

A group of photographic views showing some of the mammoth machinery, gearings, and mountings installed in the great Works of the Peninsular Portland Cement Co., Cement City, Mich., and the National Portland Cement Co., Limited, Durham, Ont. This machinery is all of special design made expressly for these plants, and from the plans and specifications of our own staff of experienced engineers. The machinery for the Works of THE WESTERN STATES PORTLAND CEMENT CO., Independence, Kan., will be designed and installed by the same staff of engineers.

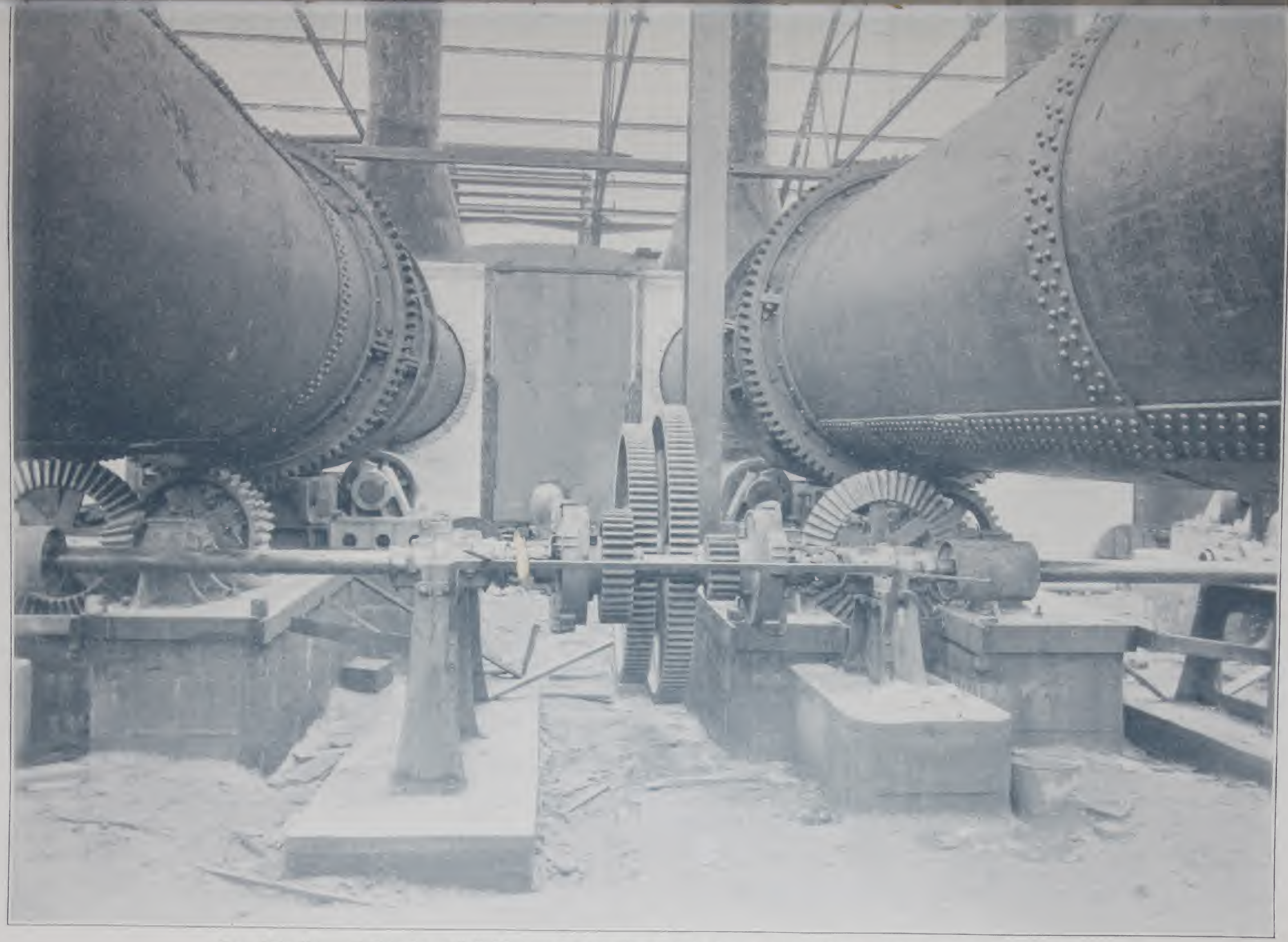
IMPROVED ROTARY KILN.

The above cut is from a photograph of one of the Mammoth Rotary Kilns now installed and operating in the great Works of the National Portland Cement Company, Durham, Ontario. This Rotary is of special design and is conceded by experts to be the crowning effort of engineering skill. The Rotaries to be used in the plant of THE WESTERN STATES PORTLAND CEMENT CO., Independence, Kansas, will be of the same type, designed and installed under the supervision of the same engineers.

GREAT PLANT OF THE NATIONAL PORTLAND CEMENT COMPANY, LIMITED, DURHAM, ONTARIO.

(COWHAM SYSTEM)

Experts concede it to be the very latest improved and best equipped Portland Cement factory in America. It must be seen to be appreciated.



Two of the Mammoth Rotaries on their Mountings, in the Works of the National Portland Cement Co., Limited, Durham, Ont.

Designed and constructed expressly for this plant. These rotaries are electrically driven, independent of each other, and are conceded to be the most efficient equipment ever installed in a Portland Cement factory.

NEW DAIRY BUILDING, TORONTO INDUSTRIAL EXHIBITION, TORONTO, ONT.

Constructed by The National Portland Cement Company.

"I believe that this is the best building for dairy exhibition purposes to be found anywhere in the world; and I say this after having been in all the prominent buildings erected for the purpose on this continent, and with a fair knowledge of similar buildings in the Old Country."

J. A. RUDDICK,
Chief of the Dairy Division of the Department of Agriculture for the Dominion of Canada.

"The dairy building is a splendid object lesson, and the finest building of its kind in America."

PROF. ROBERTSON,
Commissioner of Agriculture for the Dominion of Canada.

Canada's Great Exposition
AND
INDUSTRIAL FAIR

OFFICES-ON SITE AT EXH.

TORONTO, CANADA. September 11th, 1902.

The National Portland Cement Co.,

Toronto,

Ont.

Dear Sirs.

On behalf of the Directors of the Toronto Industrial Exhibition, we beg to convey to you a high appreciation of the splendid work your company has performed in the erection of our new Dairy Building. Knowing as we do the almost insurmountable obstacles which you had to overcome in erecting this building, we feel that it would be unjust on our part did we not convey to you our high sense of the obligation under which you have placed our Association.

You will hear from our Secretary later on that we have awarded your company a gold medal as a slight recognition of its services, as well as to the excellence of the construction of the building for which you have the contract.

Wishing your company a long and prosperous career and trusting that the beautiful building that you have erected upon our grounds may long remain as a living advertisement of your powers of manufacturing artificial stone.

I am with best wishes.

Very truly yours,
J. J. [illegible]
President.

THE MAGNIFICENT PLANT OF THE SOUTHERN STATES PORTLAND CEMENT COMPANY, ROCKMART, GEORGIA.
(COWHAM SYSTEM)
This plant is of the very latest design and equipment throughout.

CUT SHOWING THE PLANT OF THE INTERNATIONAL PORTLAND CEMENT CO., LIMITED, HULL, QUEBEC.

(Cowham System)

Modern in Every Detail.

STREET SCENE, BUSY DAY, INDEPENDENCE, KANSAS.

"Independence, the best town in the Gas Belt, the County Seat of Montgomery County, Kansas, has 8,000 Population; Free Mail Delivery; Five Rural Mail Delivery Routes; $50,000 Hotel; Paved Streets; $55,000 County High School. Two Large New City School Buildings; $100,000 Sorghum Sugar Mill; $50,000 Court House; $125,000 Window Glass Plant; Water Works and Sewerage System; Masonic Temple; $100,000 Vitrified Brick Plant; Large Machine Shops; Only Cracker Factory in the State; Three National Banks; $40,000 Cotton Twine Mill; $75,000 Straw Paper Mill; Paid Fire Department; Two Large Flouring Mills; Large Ice Plant; Broom Factory; Two Planing Mills; Natural Gas and Oil in Abundance; Gas and Oil Machinery Supply House; Fourteen Churches; Contract Closed for a Rolling Mill, Glass Plant and Bottle Factory to Cost $800,000, and a 3,000 Retort Zinc Smelter. All Factories to be Connected by Electric Line."—*Tribune Printing Co.*

City School Building.
County High School.
Carl-Leon Hotel.

Montgomery County Court House.
Business Block.

INDEPENDENCE, KANSAS.

GROUP OF RESIDENCES, INDEPENDENCE, KANSAS.

APPENDIX.

HISTORY chronicles vaguely the events of a period known as the "STONE AGE," when men wrought with the crudest of implements and eked out the merest sort of existence. But man's necessity made him progressive and his cunning taught him to devise better instruments of "BRONZE" with which to serve his purpose, only to find them in turn inferior to the improved work of his son in the "IRON AGE."

Each plays its part in the economy of NATURE, then yields place to its betters, and the STONE AGE, the BRONZE AGE, the IRON AGE retire, yielding the palm to the IMPERIAL AGE of Cement.

No product in the world has a wider application to useful purposes than Portland Cement. Men who know its worth realize that it is the only absolute fire-proof building material in the world. In this respect brick, terra cotta, iron, and granite all suffer markedly by comparison with it.

It is the ideal building material in bridge construction, whether for strength, form, beauty or durability. There has never been found a paving material on earth equal to Portland Cement concrete whether for side-walks, street-beds, or roadways. In house building there is hardly an article used that cannot be made stronger and more durable out of Portland Cement than out of any other known material.

Progress is the watch-word of the twentieth century. And it is with this thought in mind that we present the following pages showing the progress recently made in the cement business, and the present advanced ideas on cement constructive work. Our purpose here is to show something of what has been done, and to afford material for thought as to what can be done in future with Portland Cement.

THE ERA OF CEMENT CONSTRUCTION.

By JULIUS KAHN, Architect and Engineer.

IT is not generally recognized that we are at the present time in perhaps the greatest constructive epoch in the world's history. This age shall probably be classed as the steel age in 100 years from now. People in general are too busy to realize the importance and size of the works which are at the present time under construction. In fact, we are all too busy with our own personal matters to realize the greatness and significance of this movement in construction.

Whereas, 40 years ago the manufacture of iron and steel was as yet too expensive and too poorly developed, at the present time machinery and chemistry have advanced to such a high stage of development as to allow the manufacture of this material to reach a high state of excellence.

The fact that this has been done so well has encouraged engineers, builders and architects, and at the present time a majority of the buildings erected are mainly of a steel skeleton framework which supports the floors and walls, the latter being merely a light protective covering for the steel work. This high state of development in the steel industry has allowed the building of enormous structures in New York, Chicago, and all the large cities as well as here at home.

If brick and masonry had been employed, the foundations and lower story walls would probably have been so heavy and expensive that financially this size of structure could not have been made profitable. But with the use of steel the supports and foundations were made comparatively small and little floor space was occupied by them. Apparently to an outsider it seemed a mystery how the upper floors were supported on the lower, the real supporting members being entirely hidden within the masonry.

At the present time there is a revolution going on in construction in general. There are many things to indicate that we are at the present time passing out of the iron and steel age. It is only about 25 years ago that the steel age could be said to have had its modern beginning. The Bessemer and Open Hearth process of steel manufacture wrought a revolution in construction in general, and at the present time its use has reached the highest point in its history. Will it decline? This is a grave question, and from present indications it would seem that the answer must be affirmative.

There are certain things in connection with the use of steel that will not allow it to satisfy the value of the engineer and architect. If steel could be so thoroughly protected as to be absolutely fire and rust proof there would not be so many objections to it. But in these two respects it is seriously lacking. The best chemists of the country have been studying to find a rust proof covering for steel. Leading engineering societies have had the subject up for discussion continually for the last five years, but so far no satisfactory solution has been reached. One man will say he has discovered the proper paint covering, but when tested it will fail after a time like everything else that has been tried. A few years ago there was a great rush over oxide iron paint. Everybody said it was the proper material to use, and its application was really quite universal. Then it was found that rust spots multiplied underneath the covering. This was attributed to a galvanic action claimed to exist between the paint pigment and the metal. Then came the red lead theory, and many engineers were strong in advocating it, but it ended in the same way. Then the graphite theory, and Detroit may be said to be one of the first places that practiced it; in fact, Detroit claims to have built the first graphite paint factory. This paint, however, has been criticised almost as severely as the oxide of iron, as rust gathers under it in just the same way in a large number of instances, and painting must be done with great regularity. Recently chemists had advised the use of gum oil paints; that is,

paints composed of the natural gums, with pigments and oils as necessary. This gives a brief idea of the theorizing which protective coating for steel has undergone. At a discussion of a recent meeting of the American Society of Civil Engineers, a number of the most prominent members claimed to have discovered such a covering and held the same secret, not for reasons of desiring an exclusive patent right, but on account of uncertainty. As yet the paint theories are anything but reliable.

An ordinary exposed steel structure has a life all the way from 10 to 30 years, depending upon the care given it in its protection. As an example, near at hand in many of our M. C. R. R. viaduct bridges it was recently found that the steel beams were eaten through on account of the corrosive action of the gases from the locomotives, and required replacing. In fact, some railway companies are replacing steel with concrete bridges, because steel is not reliable, nor permanent; among these may be named the Michigan Central, Illinois Central, Pere Marquette and others.

The question is anything but solved. There is scarcely a month but that some man comes forward with a preparation which he hopes will do it, but so far they have all failed.

Again, steel is lacking in fireproof qualities. Under a heavy fire steel will melt like wax. Although a high temperature is required to make a liquid of it, a comparatively low temperature converts it into welding state. Under anything like extreme heat and heavily loaded, it will curl up and collapse. Unless well protected against fire, it is little better than wood construction under certain conditions. As a result of high temperatures the latter, when made of heavy timbers, will char and burn only on the outside, without deep penetration, and for this reason mill construction, which consists entirely of such timbers, is used very largely. It originated in the cotton mills of New England and is now used largely in all factory construction. In this type the floors are made of planks four to six inches wide, set edgewise and nailed together. The posts are of very heavy proportions, so as to prevent quick burnings. Buildings of this type will stand very severe fires, and there are engineers who believe mill construction to be better than steel, unless the latter be well protected. It does seem that if a new type of construction comes into use that will provide a permanent and fireproof structure, the steel age will draw to a close. At any rate, it is a subject that engineers are studying more earnestly than ever before, and they are coming to the conclusion that cement construction affords relief from these vexatious problems. Cement is now manufactured of such excellence, at such a low price, and so thoroughly answers the wants of the engineer that there is no question that it will replace steel construction. The only question is how fast it will do so. There is probably no subject so much discussed by engineers now as concrete and concrete steel construction.

It must be granted that concrete has this against it, that if poorly made, it is deceptive; but on the other hand, if the carpenter uses timber that has dry rot, is worm-eaten, or has serious knots or wind shakes, which deficiencies cannot be perceived by the ordinary layman, and even by a thorough engineer, the dangers are much greater. Thus the carpenter may deceive. Again, steel work may be even more dangerous and deceptive if the connections and sizes are not right, or if anything about its make-up is slighted. These risks must be carefully guarded against. The engineer figures heavy loads for every square inch of steel, and the dangers are proportionately greater if workmanship or quality of material is below the standard; he is careful that a test be made from every batch of material. Then, again, he guards against the workman's poor riveting, the winding of steel members, the security of connections, etc. There are a hundred ways in which errors can creep in, any one of which may wreck his structure. It must be assumed that skill is not required to such an extent in concrete work. If a good brand of cement is used, it only remains for the superintendent to watch the proportions of mixing, its manipulation and placing in structures, and he is assured that the strength is ultimately there. There is this consolation, too, instead of it becoming weak with age, as steel, owing to its corrosion, or as wood, owing to its rotting, the strength of cement construction continually increases and moisture only serves to make it harder.

Again, it is as fireproof as any material known. If this is so, the question may be asked, why is cement not used more largely at the present time? In answer I will say:

"It is only very recently that America was able to produce the excellent quality of cement it now produces, at a marketable price. Europe led us, but Europe is now conservative, and our rapid strides have placed the American product in the front rank."

It is no longer as it was ten years ago, that European Portland cements are specified in our best construction works. Now American Portland cement is used. In fact, it is probably only seven or eight years since we made Portland cement in any considerable quantities. Our own cements were formerly the natural cement, but in the past few years America has put up Portland cement factories not only equal, but far superior to those in Europe.

But, again, used under other conditions, cement is as effective as steel, without its defective qualities. Concrete is excellent when used in compression, but it is not so good as timber in tension, as it has about one-fifth of its tensile strength. For that reason engineers did not formerly use concrete where such strains were carried. But now comes a new method, called concrete steel, or "reinforced concrete" construction, which enables us to use cement in tension as well as in compression. This type of construction will work a revolution in the use of steel, for, if concrete with steel imbedded in it, be as good in tension as in compression, then it is an ideal material, for it gives the necessary strength, is fireproof and permanent.

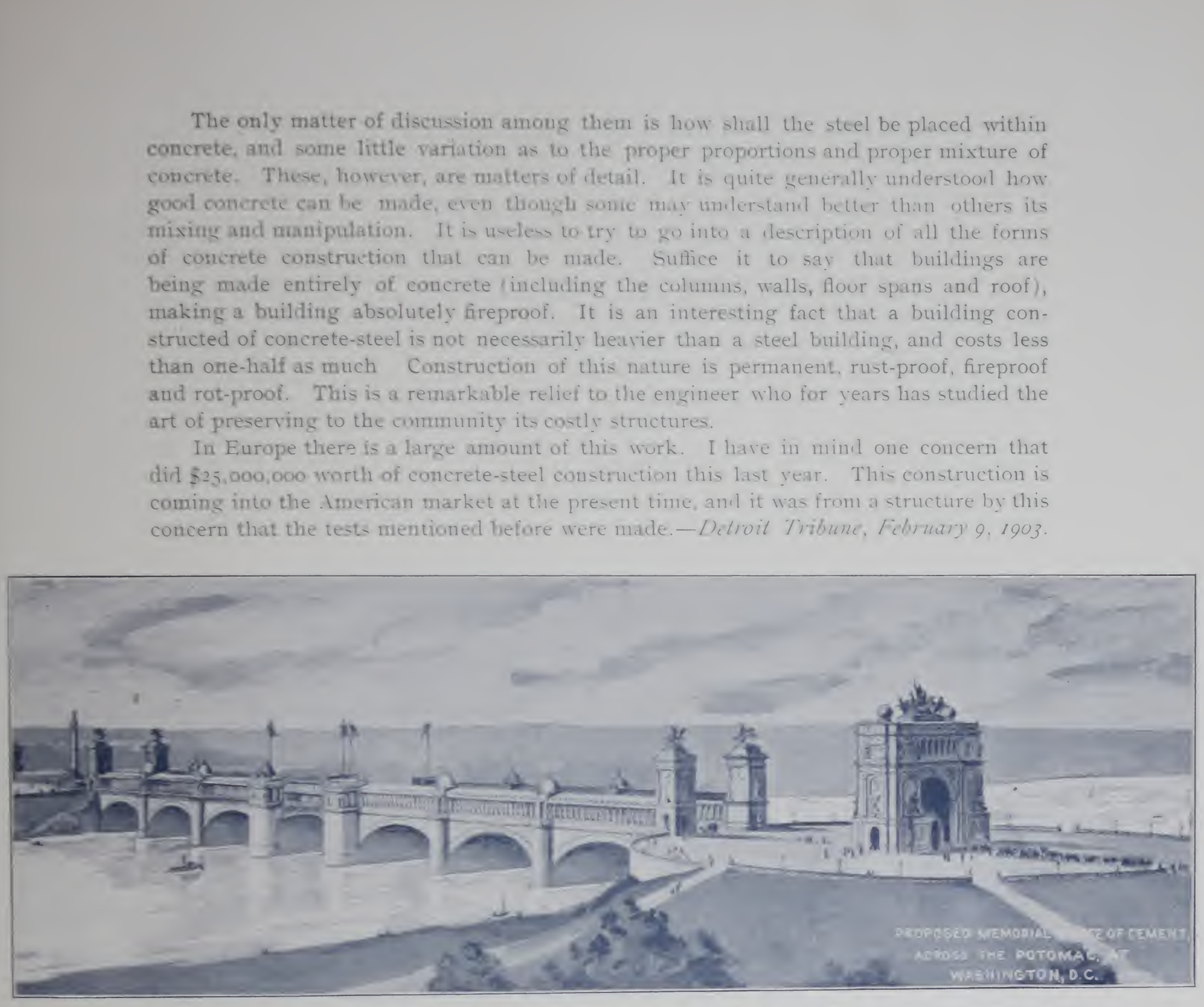
Probably no subject is now so much before engineers and engineering societies as concrete steel construction. Different engineers have different ideas in regard to placing the steel within the concrete. There are at the present time 50 to 100 different systems or ways of doing so. These differ from one another in the arrangement of the steel within the concrete, but all agree that the steel must be placed in the concrete where it takes the tension. Of course, the concrete is used for compression. Again, there is no material which so thoroughly protects steel as concrete, and steel imbedded in concrete is as permanent as masonry itself. The simplest form of this construction is a rectangular beam, with steel rods imbedded in the lower side. With such a beam a load placed on same tries to deflect it, and the steel at the lower side comes into tension, the concrete above it into compression. The greatest virtue of concrete in this construction is the union which the steel makes with the concrete. This adhesive property of concrete was only realized in the last few years and gave birth to the present concrete-steel system of construction. As before stated, there are from 50 to 100 systems. Some of the best ones came from Europe in just the same manner as the best Portland cements originally came from Europe. A few of the European are the Von Emperger, the Monnier, the Considere, the Hennebique, etc., and in this county we have the Ransome, the Expanded metal, the Columbian and the Johnson, etc. These systems are well represented by many structures at the present time. They all have in common the placing of steel on the tension side of the concrete, and differ only in the form of the steel or its arrangement.

One thing more in favor of concrete is its use for long floor spans in building construction. Spans as large as 25 feet are easily constructed at the present time, and there are many records of concrete spans 50 to 100 feet long. Only very recently I was called to witness tests where the walls, floors and columns of a building consisted of concrete, with floor spans of 24 feet 6 inches. I was unable to attend, but I understand a number of very prominent engineers were present. The results of the tests were sent to me. These spans carried without serious deflection a load of 100,000 pounds uniformly distributed over them. Two concreted steel beams supported a concrete slab four inches thick on which the weight was piled. The actual sagging under this enormous load was only 15-32 of an inch. If a steel beam of the same strength had been used, it would have settled 3½ inches, thus showing that the properties so greatly desired by engineers have been more than realized in concrete-steel, as the latter can be constructed so as to deflect under weights only one-quarter as much as steel.

There is another remarkable advantage for concrete-steel construction. In buildings constructed of brick or stone, the vibrations due to the moving parts of machinery are very great, but in the case of concrete-steel it is little or nothing. In this regard it is of great advantage in factory construction. The experimental stage in concrete-steel construction has passed by. It is an accepted fact among all engineers that concrete-steel construction has come to stay.

The only matter of discussion among them is how shall the steel be placed within concrete, and some little variation as to the proper proportions and proper mixture of concrete. These, however, are matters of detail. It is quite generally understood how good concrete can be made, even though some may understand better than others its mixing and manipulation. It is useless to try to go into a description of all the forms of concrete construction that can be made. Suffice it to say that buildings are being made entirely of concrete (including the columns, walls, floor spans and roof), making a building absolutely fireproof. It is an interesting fact that a building constructed of concrete-steel is not necessarily heavier than a steel building, and costs less than one-half as much Construction of this nature is permanent, rust-proof, fireproof and rot-proof. This is a remarkable relief to the engineer who for years has studied the art of preserving to the community its costly structures.

In Europe there is a large amount of this work. I have in mind one concern that did $25,000,000 worth of concrete-steel construction this last year. This construction is coming into the American market at the present time, and it was from a structure by this concern that the tests mentioned before were made.—*Detroit Tribune, February 9, 1903.*



The cost of this memorial bridge will be $5,000,000. The plan provides for a bridge a quarter mile long having six noble arches spanning the river three on each side of a central draw-span. The first prominent feature in the design is the open esplanade opposite the entrance to the bridge, where a fine sight of the whole composition breaks on the view. From the center of this plaza rises the imposing memorial arch enriched with beautiful sculpture. Crossing the plaza the eye is attracted by the monumental pillars marking the entrance to the bridge, and the colonnaded promenades are entered giving a fine view of the river on either side. Resting places are provided at intervals opening from the colonnades, at the projecting balconies built over the piers.

The center of the bridge is marked by the four Venetian masts bearing the National flag, and circular colonnades there provide seats, affording a fine view up and down the river. At the western end of the bridge the monument to Concord, rising from the centre of the plaza, corresponding with the one at the Washington end of the bridge, commands the attention: the whole forming a happy combination of nature and art.

There were to be nearly six million pounds of steel to support the floor of the bridge, but now this vast amount of steel is dismissed with the remark that it is a mere matter of detail, and it has been discovered that concrete arches and pillars can be used instead and probably at less cost.

M. E. Ingalls, President of the Big Four Railway Co., is erecting a fifteen-story armored concrete office building on Fourth and Vine streets, Cincinnati, O. Mr. Ingalls, while a guest at a special dinner of the Picadilly Club, at which the topic of the evening was sky-scrapers, said that he had made a thorough study of cement constructions and armored cement constructions, personally and through competent engineers and architects, and that he was thoroughly convinced that armored concrete was the coming building material; that it possessed superior properties over the ordinary skeleton steel construction, while work could be executed at less cost in armored concrete than in steel: that it was more durable than steel, and that he had unbounded confidence in this form of construction.—*Cement and Engineering News.*

Importing Portland Cement seems to be quite a lively business yet, and practically so along the Pacific and Southern Coasts.—*Rock Products.*

The probabilities of an Isthmian canal together with calls for cement in Cuba and other South American countries, is a suggestion to cement people that mill sites on the sea coast are advisable, to take care of the export trade.—*Rock Products.*

FUTURE BUILDINGS TO BE OF CEMENT.

Walls and Superstructures of Concrete from Canadian Material.

CRIB WORK AND DAMS, TOO.

THE MEMBERS OF THE ENGINEERS' CLUB DISCUSS THE GROWING CEMENT INDUSTRY.

Last night the Engineers' Club of Toronto held an important meeting in their rooms, King street west. The gathering, which included some of the city's foremost minds in engineering and building, was presided over by Major Henry A. Gray. The discussion was over the general use of concrete in building at the present time, and it seemed the concensus of opinion that stone masonry was a thing of the past, and that cement concrete will not only be used in foundations in future, but in the walls and all superstructures. The discussion was led by City Engineer Rust, who drew attention to the remarkable growth of the cement industry throughout the American States. Quoting the mineral resources report of the United States for 1900, he said that in 1894 the production of the 24 cement works in the States had been 798,000 barrels, while in 1900 50 works had produced eight and one half million barrels. The imports for 1900 were over 2,300,000 barrels, while the total consumption of Portland Cement in 1900 was over 10,700,000 barrels.

GROWTH IN CANADA.

The City Engineer was unable to quote the figures of the Canadian growth of the cement trade, and light was thrown on this by Mr. M. J. Haney, who is a member of the club, and a well known civil engineer and contractor. The proportionate increase in Canada has been as remarkable as the increase across the border. In 1891, 100,000 barrels of cement were used in Canada, and of this 25,000 barrels only were made in this country. But in 1901, Mr. Haney explained, 1,000,000 barrels were consumed in the Dominion, and of this 500,000 barrels were produced at home.

This report of the splendid stride in one of Canada's most important branches was greeted with applause which was repeated when Mr. Haney said that he believed the proper sentiment for Canadians to show was, all things being equal, to support home industry. He did not believe in importing anything into Canada that could be secured at home.

CEMENT IN CRIB WORK.

The learned gentleman from the City Hall turned his searchlight upon the question, "Should not concrete be used instead of cribwork in permanent harbor works?" and gave his opinion that he would, except in cases where stone could be procured in suitable proximity to the work, use concrete for bridge piers and abutments. Cement concrete, Mr. Rust says, makes better work and cheaper work. It was here that the City Engineer expressed the opinion that stone masonry will soon be a thing of the past, and that it will be simply a matter of time when Portland Cement concrete will be used in the construction of buildings not only for foundations, but for the outside walls and partitions. Later in the evening the Engineer gave the interesting information that concrete has reduced the cost of permanent work from $12 a yard to $5.25 a yard.

Major Gray followed the City Engineer, and made a few mysterious passes on a blackboard with chalk. These passes were intelligible only to the engineers, but what the gallant major was driving at was that in the construction of breakwaters and piers, while it would cost but $3 a cubic yard for wood and stone construction, concrete would

give a job for all time for $6 per cubic yard. It was shown that twelve feet of wood and stone was not as strong as six feet of concrete, and that by reducing the sectional area, concrete could be utilized as cheaply as stone and wood.

"What is the life of concrete?" asked a voice.

"Well, I know some that has been in existence over 1,000 years, and it is about as good as new."

SUCCESS ON SOO CANAL.

One of the principal speakers of the evening was Mr. M. J. Haney, who from his large and practical experience was listened to with great interest. Mr. Haney said in part :

"I have been for years an advocate of cement in Canada. My experience of concrete for the foundations has been very satisfactory." Mr. Haney then explained the admirable manner in which the concrete has stood the test at the Soo canal, where the foundation carries as heavy weight as any in the country.

In commenting on the great expansion in the cement industry, Mr. Haney compared the progress with strides in steel. He was of the opinion that now builders found that if their great structures were to last, the concrete must give the life to the steel by covering it and keeping it from the action of the air.

Mr. H. F. Duck spoke on the durability of concrete, and instanced a case in Wisconsin where he was interested in the building of a dam 200 feet wide, in which 100 feet of stone was used and 100 feet of concrete. The stone was convenient but the 100 feet cost double the price of the concrete, and is wearing away so fast that it will be torn out and the entire dam built of concrete.

City Engineer Rust rubbed it into the government and railways for neglecting to use Canadian cements years ago, and Major Gray replied that the Minister of Public Work was fully cognizant of present facts, and that as far as practical all works now are being built with concrete and Canadian cement.—*Toronto Daily Star.*

CONCRETE BRIDGE, YPSILANTI, MICHIGAN.

(Peninsular Cement used exclusively.)

Concrete bridges are practically indestructible; they cannot rust and will not disintegrate; require no painting, no floor renewals, no repairs, and no attention of any kind. A cement concrete bridge once built is built for all time; it is more durable and more economical than either steel or stone, and is flood proof, rust proof, fire proof, and frost proof.

A PORTLAND CEMENT MONUMENT.

This monument is 24 feet high, 14 feet wide, 6 feet thick, and contains over 80 tons of Portland Cement concrete It has 22 medallion heads around the base and 6 full length statues above. The monument is one solid mass without break or joint, cast where it stands entirely from Portland Cement, and required less than three days chiseling and dressing to put it into presentable form. It is the work of the sculptor Warren S. Cushman, of Bellefontaine, Ohio.

MODERN STRUCTURE.

LUDINGTON, MICH., June 26.—The Stearns hotel in Ludington marks a new stage in architectural development. It first proves that a building of cement can be made attractive on the exterior. The cornice and porch are distinctly ornamental and the only wood employed is in the capping of the porch pillars.

The walls of the building are hollow and put up by machines which form blocks ten inches high by thirty long. The outside wall is four inches thick, with a three-inch air space and the inside wall five inches thick. The crushing resistance of the cement is 5,500 pounds to each cubic inch, so there is no danger of the building being crushed in.

The most startling departure is in the construction of the boiler arch of the heating plant of cement. Fire has been in the fire box all winter, and results are entirely satisfactory. Of cement, a train load, or 30 cars has been used. The average cost of a brick wall, 12 inches thick, is from $25 to $40 per 100 square foot of surface. The cost of same of Portland Cement is $15.34, showing a decided saving in the cost of construction. Any wall is liable to crack on long exposure, but the cement wall, where constructed of *best* cement, is a thing as lasting as the hand of man can create. The cost of the building was about $55,000, and the furnishings $15,000. It will be opened July 1.—*Detroit Journal.*

CHEAP CEMENTS NOT ECONOMICAL.

They Shouldn't be Used for Public Works, Declares Analyst Clark—Condemns Loose D. P. W. Specifications and Offers Suggestions for Their Improvement.

County Chemist John E. Clark, in a communication to Ald. Black, supplementary to an analysis of cement, discusses the general proposition of cement as it relates to paving done under the direction of the department of public works. He quotes this statement from the *American Cement Industries*, and indorses it:

The City of Detroit does not require much variety of test and may secure cement under its specifications which, while passing the test required, is deficient in a marked degree in many other respects. "The method used at present by the department of public works," declares Dr. Clark, "consists in the determination only of tensile strength and fineness. Chemical analyses are never attempted.

"A careful consideration of all the factors that go to make up the cement for city paving leads me to the firm opinion that we err on the side of economy in adopting these cheap cements for public work. While the cement submitted to me is inferior to what should be required by specifications carefully drawn for street concrete it complies with the present specifications of the department of public works as interpreted by its officials.

"I would suggest as a remedy for the present condition of affairs that the department of public works require a new set of specifications asking for in all cement submitted: Determination of fineness, liability to checking or cracking, determination of tensile strength, determination of crushing strength, determination of variation of volume, analysis to determine chemical composition and that proper apparatus be secured for this purpose."—*Detroit Evening News, June 30, '03.*

TO USE PORTLAND CEMENT.

The City will probably use Portland Cement in its street construction hereafter. Hitherto natural cement has been used, and the committee on streets in the course of its paving investigations has found it of poor quality. The concrete with which it was made has never been found to be hard enough to prevent seepage. Commissioner Maybury has investigated the various sorts of cement and arrived at a similar conclusion. At the meeting of the committee on streets this afternoon the commissioner will recommend that Portland Cement be the only kind hereafter used.—*Detroit Free Press, July 6, '03.*

If it is a fact that there is a better cement for paving purposes than Louisville or Milwaukee cement, Commissioner Maybury should not hesitate about ordering its use, even if there is a considerable increase in expense. Without good cement, good concrete cannot be laid, and without good concrete good pavements are out of the question. A properly laid concrete foundation should be little less enduring than the pyramids. There is no economy in using anything but the best cement, and the money the city spends for it will prove the best investment made in pavements for many years.—*Detroit Evening News, July 1, '03.*

The Beautiful new "Art Building" on the grounds of the Toronto Industrial Exhibition, Toronto, Ont.

Constructed by the National Portland Cement Company.

ARMORED CONCRETE IN THE UNITED STATES.

The rapid increase of armored concrete construction in the United States must be a source of gratification to the American cement producer, since this form of construction is destined to largely increase the demand for cement.

At this time few architects are familiar with the details of armored concrete construction. This lack of definite information on the part of architects restricts its use where it would otherwise be employed, since the architect hesitates to recommend a system with which he is not familiar. Armored concrete construction falls rather within the province of the engineer than the architect. Therefore when the capitalist seeks advice on building projects in which he desires to invest he consults the architect, who will in nine cases out of ten favor the older materials of construction, with which he is perfectly familiar. Therefore, with few exceptions, little is to be expected from architects as a class, to further armored construction in buildings of any pretensions. A case in point is the fifteen-story Ingalls building in Cincinnati, now under construction in armored concrete.

Mr. Ingalls, president of the Big Four railway, during his travels in Europe, saw numerous splendid examples of armored concrete building constructions, with which he was so favorably impressed that he conceived the idea of a magnificent building in the United States to be erected out of his own resources.

That "seeing is believing," is an old adage that has been confirmed in the Ingalls building. The local architect at once grasped the idea, that armored concrete was the proper thing, and now scarcely recommends any other construction but armored concrete.

This system of construction has in it much to recommend itself to capital, since it is safe, durable, fire-proof and economical. As compared with structural steel, armored concrete can be erected at 40 per cent less A direct saving of 40 per cent over structural steel must be a convincing argument to capital seeking remunerative investments.

This single fact, when it is thoroughly understood, will gradually cause armored concrete to be substituted for structural steel building constructions.

The architect who desires to maintain a position in the front rank of his profession must familiarize himself with the details of armored constructions; he must take upon himself the province of the engineer, who is to-day fast monopolizing the profession of modern building construction. The architect of to-day, with few exceptions, simply stands between the capitalist who invests his money in building constructions and the engineer, who substantially designs the building. The architect simply decorates and adorns the work of the engineer.

It will be a matter of surprise to our readers when we state, that there is to-day but a single firm of architects in the United States sufficiently equipped to design, calculate and execute plans for a modern steel office building, with their own proper office force. The architect of to-day must be an engineer, as well as an architect, to deal with the daily problems that confront him in the art of modern building construction. The day has passed for simple copies of Greek, Roman, Egyptian or Byzantine styles of architecture. Their buildings were erected and dedicated to the unknown gods of antiquity, and to art, while to-day we erect our commercial structures to Mammon. The first question to be solved in modern structures is, will it pay? Will it yield fair returns on the money to be invested? On these lines armored concrete becomes the ideal system of building construction, since it insures the largest returns

In order to place the details of armored concrete construction before the public, the *Cement and Engineering News* has in preparation an exhaustive treatise on the principle of armored concrete construction, for the edification of the architect and engineer to the end that this form of construction may take deep root, grow and flourish in America as it has in Europe.—*Cement and Engineering News, June, 1903.*

The Delaware Cement Brick Co., of South Wilmington, Delaware, is asking for the amendment of the city ordinances so as to permit the use of cement brick in buildings. Cement brick will be used in 127 new houses to be erected in the ninth ward should the building laws be amended to permit their use.—*Cement and Engineering News, June, 1903.*

THE INGALLS SKY-SCRAPER—Cincinnati Office Building being constructed entirely of Portland Cement.

"It is decided at last that Cincinnati is to have a fifteen-story building constructed entirely of concrete, and the permit is to issue to-day (Saturday, Dec 13)," says the *Cincinnati Times-Star*. "This kind of a structure was such an innovation that Building Inspector Tooker some time ago determined to investigate before granting a permit. Engineer L. W. Wasson, an authority on concrete construction, was brought from Boston by Architects Elzner and Anderson and delivered his report to Mr. Tooker on Thursday, and convinced the latter that the plans for the building were entirely correct. The Ingalls building is to be a conspicuous monument of one of Cincinnati's multi-millionaires, M. E. Ingalls, President of the Big Four Railroad. It will be a solid structure of artificial stone, which, it is said will grow more solid as the years go by. It will be constructed entirely of reenforced Portland Cement concrete, with imbedded steel rods. This decision was made after discovering the difficulty of obtaining steel. This form of concrete construction is very strong and durable, so much so that the retaining wall, instead of being three or four feet thick will be only about one foot in thickness. Such a structure, instead of growing discolored with age, assumes a creamy whiteness that materially adds to its appearance." *Photograph furnished by M. E. Ingalls.*

FERRO-CEMENT CONCRETE WAREHOUSE OF THE CO-OPERATIVE SOCIETY, LIMITED, AT NEWCASTLE-ON-TYNE.

This building rises to a height of 120 feet, and consists of basement, ground floor and six upper floors. The ground at the site of the building was of the worst description imaginable for foundations, and this entire structure rests on a "raft" of ferro-concrete, which covers the whole area of the ground. This raft measures two feet six inches in its thickest part and only seven inches in its thinnest part, and the idea of sinking piles or cylinders for foundations was thus abandoned, it being found that the ferro concrete "raft" system would effect a great saving, both in cost and time. The columns, floors, walls and all are of ferro concrete. The walls of the basement are only eighteen inches thick, while the walls of the ground floor are only twelve inches thick, and they are gradually reduced until the thickness at the roof level becomes only four inches. The ferro-concrete beams carrying the floors are mostly twelve inches deep by seven inches wide, and the floors are seven inches thick, their span being fourteen feet six inches. The strength of these floors has been tested up to four tons per square yard by means of ninety-six tons of pig iron gradually applied on a square measuring fourteen feet six inches. The severity of this test will be recognized when it is remembered that the heaviest locomotive in use in this country weighs, with its tender, less than ninety-six tons, and could therefore be supported on a space fourteen feet six inches square of any floor of this building.

The strength of this building as a whole is enormous, inasmuch as the sills, floors, walls and roofs are all, so to speak, tied together, and the whole forms a sort of huge monolithic structure which cannot suffer deformation from any strain it may be called on to undergo.

HOTEL GALLIA AT CANNES.
Entirely built in ferro-cement construction.

SKY-SCRAPERS OF CEMENT.

For once that veteran inventor, Thomas A. Edison, has assumed a new role—that of prophet. Cement and steel he declares are to be the building materials of the future. Sky-scrapers will be built of frame-work of steel with walls of Portland Cement, the steel work encased in cement as well.

Some of the fire insurance people will go out of business, so far as building risks are concerned, or write risks on the balance of what will be then obsolete buildings.—*Cement and Engineering News, April, 1902.*

NASSAU-BEEKMAN BUILDING, NEW YORK.

First two stories built with Stevens Cement Cast Stone—formed of Portland Cement, sand and gravel or crushed stone. The Stevens Cement Stone is perfect, dense, solid and homogeneous throughout, and can be moulded solid or hollow, and possesses a grain and structure so fine that a careful observer cannot distinguish it from the natural stone. Portland Cement is considered to be the ideal building material, and the Stevens Cement Cast Stone can now be seen in over 1,500 buildings. This form of construction is employed in the Royal Bank of Canada building, now being erected in Havana, Cuba.

THE CEMENT AGE.

"The use of Portland Cement is in its infancy, and the manufacture of it on a large scale is only beginning in this country. Cement promises to replace stone for all kinds of heavy foundations and other wall works, to replace stone for paving, to replace brick very largely for building and to replace lumber where lumber has been used. In fact, cement will soon be, next to steel, perhaps more than steel, the chief building material of this continent. Our houses will soon come to be of cement, and every day sees the field for the use of cement growing at a surprising ratio. The fact that the city of Toronto is experiencing such a shortage of cement at present that a great deal of the sidewalk laying arranged for this season may have to be laid over till next spring, alone constitutes a key to the true situation."—*Toronto World, Sept. 27, 1902.*

Residence of Mr. W. E. Ward, Port Chester, N. Y., [illegible]

A hotel is under construction at Ludington, Mich., costing $40,000. It will be built entirely of Portland Cement concrete.—*Cement and Slate, October, 1902.*

Petoskey, Mich., has erected four concrete houses, made of molded cement building blocks. A factory for the manufacture of these blocks is now under way.—*Cement and Engineering News.*

Architect John [illegible] has just finished plans for a twelve-story store and office building, and two eighteen-story store and office buildings, to be erected in the business section of Philadelphia. All these buildings will be constructed on improved plans. Portland Cement concrete will be used exclusively. No steel skeleton work will be used.—*Cement and Engineering News.*

CEMENT RESIDENCES.

These houses, built out of Portland Cement imbedding expanded metal, give eminent satisfaction and are meeting with marked popularity, as cement constructions generally have done. When once such a building is erected in a community others of like character immediately follow it. Hence it is that certain localities like Southern California, Southern Ohio, and Northern Illinois afford so many illustrations of such structures.

ST. JAMES P. E. CHURCH, BROOKLYN, N. Y.

Constructed entirely of Portland Cement.

ST. JAMES P. E. CHURCH, BROOKLYN, N. Y.

THE illustration on opposite page is a reproduction of a photograph of St. James P. E. Church, located at St. James place and Lafayette avenue, Brooklyn, N. Y. It covers an area of over 11,000 square feet, and has four gables 60 feet high and a tower 80 feet high. It represents the most artistic and substantial building constructed of cement concrete in America, and it is doubtful if in the world there is a more convincing argument in favor of cement construction. The application of cement concrete for building operations of an artistic nature is generally misunderstood; the completion of St. James Church is, therefore, a lesson of much value to the directors of building operations.

One cannot doubt, as he views this magnificent structure, that the successes of the early Roman builder in applying cement concrete for important engineering and architectural operations will be surpassed in the present generation. The early Roman architects and builders have given to the present age the testimony of their faith in works of cement concrete that have endured the ravages of time and still exist side by side with natural stone, offering evidence to the fact that their judgment as to the durability of concrete was correct in every respect. The production of a cement suitable for this class of construction was discontinued and remained for ages among the lost arts until 1824, when the discovery of a process for treating limestone gave the world Portland Cement. Since the date of its first manufacture a continual improvement has been made in its quality, until to-day a cement of superior quality is being manufactured. The modern builder has familiarized himself with its advantages and studied its nature. The manufacture of cement has become a science and its application a study by the most progressive engineers of the world. The specialist in concrete construction became a necessity occasioned by the rapid progress made in adapting cement to many and varied uses and conditions. It is a safe conclusion, judging from the record of the past few years of wonderful progress made in Europe and America, in developing a true understanding concerning cement and its uses, to prophecy that the engineer and the architect of the present day will give to posterity examples of their best creations built of cement concrete.

Upon viewing St. James Church one is impressed with the general appearance of the entire work. The color is beautiful and even, and while appearing as if constructed of the highest grade ashler from a distant view, shows its superiority in general effectiveness upon a closer inspection. It has an exterior appearance of rock-faced massive granite; and from the standpoint of durability and beauty it is admitted to be much superior to a church that stands near by constructed of natural stone at three times the cost.

NATIONAL GALLERIES OF HISTORY AND ART, WASHINGTON, D. C.

Under process of construction out of Portland Cement. Will cost when completed $10,000,000. Would cost in stone $40,000,000.

D. H. Burnham & Company, architects, of Chicago, Ill., have filed plans for a $1,000,000 office building, to be located at Broadway and Twenty-second street, New York City. All of the rooms will have cement floors.—*Cement.*

CINCINNATI BALL PARK GRANDSTAND, CONSTRUCTED ENTIRELY OF PORTLAND CEMENT.

A striking instance of modern cement construction is the new and elaborate grandstand and club-house of the Cincinnati (Ohio) base ball club. The length of the stand is about 300 feet and semi-circular in form, and 85 feet wide, with a drop of about 18 feet in this latter distance to allow for the slope of the seats. The boxes in front project as the picture shows, about eight feet beyond supports, and the cornice comes out the same distance. This was done entirely by using the concrete for compression and twisted steel bars for tension in the various structural members, no other steel being used.

A concrete club house was built underneath the grandstand. Some of the spans in the grand-stand proper are 40 feet long. The roof is also made of Portland Cement concrete.—*The Detroit News-Tribune.*

CEMENT AND BUILDING MATERIAL.

Grand Rapids, Mich., bricklayers and masons have taken a stand against the use of cement for walls of buildings. To them this innovation seems harmful to their trade. Doubtless, it may prove so, as cement is coming into use more and more as a building material. Thus far it may be considered to be only in the infancy of its development. Perhaps it will be just as well to have some understanding reached without bad feeling. If cement is to be the coming building material, however, it will be idle for masons to attempt to prevent its use. By becoming adepts in the handling of this material these tradesmen can continue to find profitable employment. By fighting its use and permitting others to become experts, bricklayers may eventually find the demand for their labor greatly reduced It is worse than useless for these workers to attempt to get in the way of progress.—*Cement and Slate, October, 1902.*

A NOTABLE ACHIEVEMENT.

Some of the greatest engineering feats of to-day are being accomplished by the use of Portland Cement. The new Croton Aqueduct and dam, the New York subway, the immense tunnel for 4,000 feet under Boston Harbor, and the 15-story Ingalls Building in Cincinnati are only a few of the notable engineering feats accomplished by its means. So great has become the demand for this material that its manufacture is fast taking rank with the greatest industrial enterprises of the age. It is being used with steel in many great structural operations, and in many others it is entirely replacing it. In the erection of residences it has already begun to take the place of wood and brick to a large extent. It is just as available on the farm as in the city, and for barns and outbuildings as well as residences. Paving foundations, sidewalks, walls, cisterns, etc., are only a few of its many present uses.—*Cement and Slate, October, 1902.*

THE ISTHMIAN CANAL.

"The cement manufacturers, it appears, have not yet waked up to what the building of the Isthmian Canal means to them. The construction material that will be required is almost beyond calculation. The canal will have huge blocks of concrete masonry which will require hundreds of thousands of tons of cement. The facing of the canal, the foundations and walls of electric light, power and storage plants, of naval stations, army barracks, and forts, sea walls, dams, breakwaters, piers, docks, jetties, and marine dry docks will require cement in such quantities that will give fortunes to manufacturers. And what will be particularly gratifying to the fortunate contractors, is the fact, that they will be furnishing the material to the government, which has the credit of the world back of it. Would it not be well for our manufacturers to 'get a move on' in time and endeavor to share in the good things soon to be offered to the public."—*Cement and Slate, Sept., 1902.*

COAL BIN OF CEMENT AND STEEL.

A coal storage plant constructed of a combination of steel and Portland Cement concrete has been recently built for the Lowell Gas Light Company at Lowell, Mass. It has a capacity for 25,000 tons of coal, and has a length sufficient to accommodate ten cars at one time on the siding which extends along the side of the structure. This is one of the most novel uses which has been made of the combination of cement and metal.—*Cement and Slate.*

The new cell building of the Virginia state penitentiary at Richmond will be constructed of Portland Cement concrete: bids will be asked as soon as the specifications have been completed.—*Cement and Engineering News, August, 1902.*

NASSAU COUNTY COURT HOUSE, MINEOLA, LONG ISLAND, N. Y.

MOST IMPORTANT BUILDING EVER CONSTRUCTED OF PORTLAND CEMENT CONCRETE.

General dimensions, 175 x 95 feet in form of inverted T; height, 36 feet, and to apex of dome, 65 feet. The foundation, walls, floors, pillars, partitions and dome of cement concrete. The building is practically an immense rock, cut and dressed with architectural ornament, on the exterior, and mined inside in the form of rooms. The concrete is finished in a most satisfactory manner; both smooth and rough surfaces are produced with perfect success. The appearance is so perfect that the difference between natural stone and the concrete is indistinguishable. This building represents a class of construction that is certainly ahead of anything known to the building world as regards its fire-proof qualities, and presents sufficient evidence in every way to convince the architect and builder who may have the opportunity to inspect it, that this method of construction is deserving of its great success. The Court House is connected by a concrete tunnel with the jail, which is also built of Portland Cement.

AN APARTMENT HOTEL ON JOHNSON PARK, BUFFALO, N. Y.
Portland Cement concrete construction throughout

E. R. Pelton, of Vermillion, Ohio, will erect a large Portland Cement concrete apartment house on Highland avenue near Detroit street, Cleveland, *Ohio.—Cement*.

AN EXAMPLE OF PERFECT CEMENT CONSTRUCTION.
Court Room of Nassau County Court House, shown on opposite page.

ARCHIVE BUILDING, FOR NATIONAL RECORDS, PARIS, FRANCE.

Walls, floors, stairs, landings, cases, shelving, partitions, all are of Armored Portland Cement Concrete. The entire structure is thus made absolutely fire-proof.

A REMARKABLE DEMONSTRATION OF THE ABILITY OF PORTLAND CEMENT TO SUCCESSFULLY RESIST THE ACTION OF FIRE.

Architects and builders have sounded their praise to concrete as a fireproof material. The ablest scientists have approved of its use. Laboratory tests and fire tests have demonstrated its value. The burning of buildings having cement fireproof floors has shown in a most thorough manner its ability to resist fire, and yet, with all this evidence, there has never been as perfect and complete a test brought to the attention of the builders of the world as that contained in the evidence after an intense fire had raged for hours in the factory of the Pacific Coast Borax Company, at Bayonne, N. J., on the night of April 11, 1902:

The building was four stories high and covered an area of 200x250 feet. The roof and partitions were of wood and the building contained a large number of wooden bins, boxes and barrels and other combustibles. The fire originated from the bursting of an oil main, which supplied fuel to the flames. The entire contents of the building were destroyed. The extreme high temperature reached fused the cast iron parts of the machinery, while the walls and floors of the building, of cement concrete construction, were scarcely injured. The repairs to this part of the building can be replaced at less than $1,000.00. The 150 foot Portland Cement concrete chimney was not damaged.

CONCRETE PORTION AFTER THE FIRE.—This view shows the condition of the concrete floors, walls and columns of the third story where the fire was most severe and the heat

sufficient to fuse copper. The entire concrete construction sustained, without injury, a most severe test, including intense heat and the application of cold water on its heated parts, besides resisting without injury the falling bodies of many tons weight. The concrete is in perfect condition. The plaster has chipped off in a number of places and excepting one place where 18 tons falling 14 feet slightly damaged a floor beam, no repairs will be necessary. The illustrations offer a true means of comparison between the value of metal and concrete as fireproof material.

METAL PORTION AFTER THE FIRE.—This reproduction of a photograph shows the condition of the heavy metal columns and girders in the one-story part of the building where the fire was less intense than in the part of the building constructed of cement, and where the weight sustained by the metal supports was comparatively light. The tangled mass of metal bent, twisted, broken and destroyed, a complete collapse, wrecking the entire building, demonstrates conclusively that metal becomes, under the action of fire, a destructive agent, aiding and not preventing, the flames in their work of destruction.—*Cement.*

PORTLAND CEMENT RAILWAY STATION, BISMARCK, N. D.

(Showing exterior and interior view.)

The Northern Pacific Railway has constructed a passenger station of Portland Cement concrete at Bismarck, North Dakota. The building is 189 feet long by 50 feet 8 inches wide at the middle, the general width being 33 feet. The middle part is two stories high, with towers, flanked with waiting room, 48 x 48, and baggage and express rooms, each 28 x 28. The main entrance is between six concrete columns. Marble screenings were mixed in the cement for the outer walls, producing an onyx effect. The building walls are hollow and the towers solid. The roof is of tile, which also forms the ceiling. The inside finish is in terazzo, and there is no woodwork except door and window sashes and the ticket office floor. Radiators are hung on brackets to leave the floor clear. The construction was on hospital lines, that is to catch the least amount of dust and germs, and everything can be washed down with hot water and soap. The platforms are of concrete and all sign boards and signals are suspended from concrete columns by iron brackets.—*Cement and Engineering News.*

PORTLAND CEMENT BUTT FOR TELEGRAPH POLES.

PORTLAND CEMENT BUTT FOR TELEGRAPH POLES.

By the use of the cement butt old rotten poles are simply cut off where they are decayed and reseated on a permanent cement footing, which restores the old pole to its original height. A line of poles in actual service can be easily rebuilt without disturbing the wires carried overhead or removing the pole from its standing position. It is estimated that a saving of from 35 to 55 per cent. is made in reconstruction by the use of the cement butt on poles carrying overhead wires. New poles can be purchased five feet shorter and the cement butt added to give it the length required, thereby making a saving in the first cost in all future renewals of the line. The cement butt is a conspicuous example of the invasion of Portland Cement specialties into other fields, and gradually displacing in whole or in part the old materials of construction.

Cement butts have been in use for the last three years, and have proved most satisfactory. Fence posts made entirely of this material are now in general use, and it seems apparent that the day is not far distant when all telegraph, telephone and trolley poles will also be made exclusively of this material.

PORTLAND CEMENT CONCRETE HOTEL AND DEPOT BUILDINGS.

PORTLAND CEMENT CONCRETE HOTEL AND DEPOT BUILDINGS.

The Atchison, Topeka & Santa Fe Railway Co. has erected a magnificent hotel, the Alverado, and depot buildings at Albuquerque, N. M., constructed of Portland Cement concrete in the old Spanish mission style after the plans of C. F. Whittlesey, architect, of Chicago. The hotel is over 300 feet long, built around a court or peristyle and is connected by a 200-foot arcade with the new depot which is shown on the left, while the hotel is shown on the extreme right hand of illustration. The entire collection of buildings represent the most elaborate, artistic and picturesque design in concrete construction heretofore attempted and carried out by a railway corporation.

CEMENT.

The great United States government canal of the Sault Ste. Marie, through which passes a greater vessel tonnage than through the Suez Canal, is made durable by the use of Portland Cement; the supplies of water at the greater water works at Omaha and Denver are retained by the use of Portland Cement; the great locks in the Ohio River are made secure by Portland Cement, and the great breakwater at Marquette, Mich., is made to last for generations by the use of almost imperishable Portland Cement. These two latter were constructed by the general government. The demand for this cementing material is constantly on the increase from the Great Lakes to the Rocky Mountains and south and east to the Ohio River and Alleghany Mountains. Its wonderful cohesive and adamantine hardening qualities are recognized by the United States Government Engineers, who have given it most thorough and crucial tests, and is pronounced by them to be unsurpassed, and rarely equalled for lasting qualities.

In addition to the Portland Cement being used in great constructive work, it is also in great demand in municipal work in tunnels, sewers, etc. Wood is fast becoming obsolete in works which are subject to the wearing and destructive effects of water, and cement is being substituted in their construction wherever possible.—*Cement and Slate.*

CONCRETE BUILDINGS.

Selection of concrete to supersede steel in a 15-story building is of particular interest to the cement industry, as the success of this innovation in building will open up a wonderful market for that product and give an impetus to the industry that will be of exceedingly great benefit. Architects have been slow to recommend the substitution of concrete for steel for high buildings. The Ingalls building which is to be put up in Pittsburg, is to be 15 stories high, with retaining walls less than a foot in thickness with imbedded steel rods. A mass of concrete columns will support the floors, which will be of solid slabs of concrete, six inches thick. A saving of one foot to the floor will thus be made, which will amount to 15 feet in this building. The difficulty of securing structural steel on time has long disturbed and delayed building here and elsewhere. This condition caused architects all over the country to cast about for a material that would make buildings absolutely fireproof and at the same time avoid that phase of construction which, in case of fire, caused a warping of the structural skeleton work. That concrete has been used in many instances in low buildings with marked satisfaction has long been a matter of history, but whether concrete would stand the strain incident to tall buildings was a matter of speculation until a practical demonstration was made in many cities of Europe. It is asserted on the highest authority that by degrees steel work is being eliminated from European buildings. The architects say that the structure when completed will be the handsomest in the city. The interior walls will, as soon as completed, be ready for the plaster. They claim that if the building is filled with inflammable matter and a fire ensues, burning will occasion but little loss to the structure proper. They predict that this style of construction must of necessity supersede all other kinds of fireproof construction.—*Construction News, July, 1902.*

In Chicago, under an ordinance of the city council twenty-nine miles of track elevation is called for. The railway companies will use cement for all the masonry required in the work to be done under this ordinance.—*Cement and Engineering News.*

The Jamestown, Lake Chautauqua & Lake Erie Railway has completed a concrete culvert 300 feet long, using nearly 6,000 barrels of cement in its construction.—*Cement and Engineering News.*

The Wabash Railroad is using cement concrete at various points between Maumee and Montpelier and Butler and New Haven, Ind., for piers, abutments, culverts, etc. *Every railroad in the United States now has cement specifications*, because Portland Cement concrete is recognized as furnishing the cheapest and most durable construction. The Portland Cement age is just beginning, and those interested have a great era before them in the manufacture of this material that now has such a wonderfully increasing demand.—*Cement and Engineering News, January, 1902.*

GERMAN CONCRETE RAILWAY TIES.

GERMAN CONCRETE RAILWAY TIES.

We illustrate a section of the German state railway near Briesen, Germany, laid with armored Portland Cement concrete ties. The rails are fixed to the ties by an automatic locking device in which the grip between the tie-hooks and rail is increased directly in proportion to the weight of the train or individual car passing over the rail, in other words the grip of the hook plates on the rail automatically adjusts itself to the load. The rail hook plate releases its tight grip on the rail as soon as the load of the train or individual car has passed. The object of this automatic rail gripping device is to give some degree of elasticity to the roadbed; where concrete ties are used, a ridged bond between the rail and concrete tie does not give sufficient elasticity in actual service to be economical on the rolling stock.

This particular section of roadbed at Briesen station has been in actual use since September 28, 1877, on side tracks as well as on the main line under heavy traffic. The ties are in perfect condition to-day.

A cement railroad tie, the invention of C. A. Ford, of Albion, Mich., is now being tested by the Michigan Central Railroad, and it is reported as being very satisfactory in every way.

THE 65-FOOT LIFT LOCK ON THE TRENT CANAL, PETERBORO', ONT.

This Lock is the largest of its kind in the world, and is constructed entirely of Portland Cement concrete, over 30,000 bbls. being used.

The new waterworks scheme for Birmingham, England, now on the eve of completion—the greatest water scheme that has ever been attempted—a work involving the use of many THOUSANDS OF TONS of Portland Cement. The water is first stored amongst the mountains in six cement reservoirs, the total storage capacity of which is 17,360 million gallons, and they cover an area of 1,499 acres. From the storage reservoirs the water is conducted 80 miles across country, through mountains and over valleys and rivers by the aid of cement bridges, culverts, walls, tanks, tunnels, etc., to the large cement service reservoirs and filter beds shown in illustration here. Of cement concrete work there are 8½ miles of tunnels, 35 miles of cut and cover, and 34½ miles of iron pipes—the cut and cover and tunnels being 8 feet in diameter.

The site of this extensive concrete reservoir, shown above, covers a space of three-quarters of a mile in one direction and 1¼ miles in another. The walls, formed entirely of Portland Cement concrete, are 16 feet thick at the base and about 35 feet in height. The water is delivered from this reservoir into a series of 18 quadrangular filter beds, ranging from 150 to 220 feet square, and forming a total filtering area of 67,000 square yards. These filtering beds are also wholly constructed of Portland Cement concrete.—*Cement.*

COTTON MILL AT LILLE, FRANCE.

This construction, one of the first made in Armored Portland Cement Concrete, Hennebique System, is very deep and large, and needed plenty of light, and for that reason was established simply by a skeleton in Armored Cement Concrete, and the exterior walls instead of being either in brick or in concrete, were formed largely by the windows.

What is remarkable in that construction, which is of comparatively small dead load, is, that although it is provided with engines producing very considerable shocks, no apparent vibration is to be noticed.

INTERIOR VIEW OF PORTLAND CEMENT WAREHOUSE.

This form of construction is especially adapted for warehouses and factory buildings where provision must be made for heavy loads.

EXTERIOR VIEW OF POWER HOUSE, NATIONAL PORTLAND CEMENT CO., DURHAM, ONT.

Entire Construction Peninsular Portland Cement.

Cement concrete foundations, floors and walls in the power plant of the Southern California Power Company, at Santa Ana Canyon The walls are without buttresses. The side walls are 130 feet long and the end walls 40 feet. The walls are two feet thick to within five feet of the bottom, which consists of a footing course five feet wide. This wide foundation was adopted on account of the structure being built on so insecure a foundation as the river bed of a California stream Water has since risen and fallen around this work many times to the surface of the ground, without causing any settling or cracking of this work.

PORTLAND CEMENT CONCRETE STORAGE TANKS.

The above engraving shows two of the four cement concrete storage tanks of the Illinois Steel Company, at South Chicago, Ill. They are 25 feet in diameter by 50 feet high. The bin walls are 7 inches thick at the bottom and 5 inches thick at the top.

PORTLAND CEMENT CONCRETE CHIMNEY.

Central Lard Co., Jersey City, N. J.

Height, 108 feet; diameter of flue, 8 feet. About 350 tons of material were used in this construction.

HOLLOW CEMENT CONCRETE BUILDING BLOCKS

Ready for use in the walls of the great works of the National Portland Cement Co., Durham, Ont.

PORTLAND CEMENT CONSUMPTION.

Dock foundations, retaining walls, abutments and piers above shown are all constructed out of Portland Cement.

THE unusual large demand for Portland Cement during the present season, together with the constantly increasing output, has evoked numerous inquiries of what becomes of the cement produced, and in what class of constructions the greatest amount is consumed. Fully 60 per cent. of the cement output is consumed in municipal corporations, large and small, in public and private constructions, such as sidewalks, foundations for street paving, combined curb and gutter, basement floors, telephone conduits, bridges, tunnels and subways. Prominent examples are New York and Boston subways and the Chicago telephone tunnel. The latter is a modest enterprise as compared with the New York subway, which will consume several million barrels of cement, while the Chicago telephone tunnel will require at the rate of 100,000 barrels per annum.

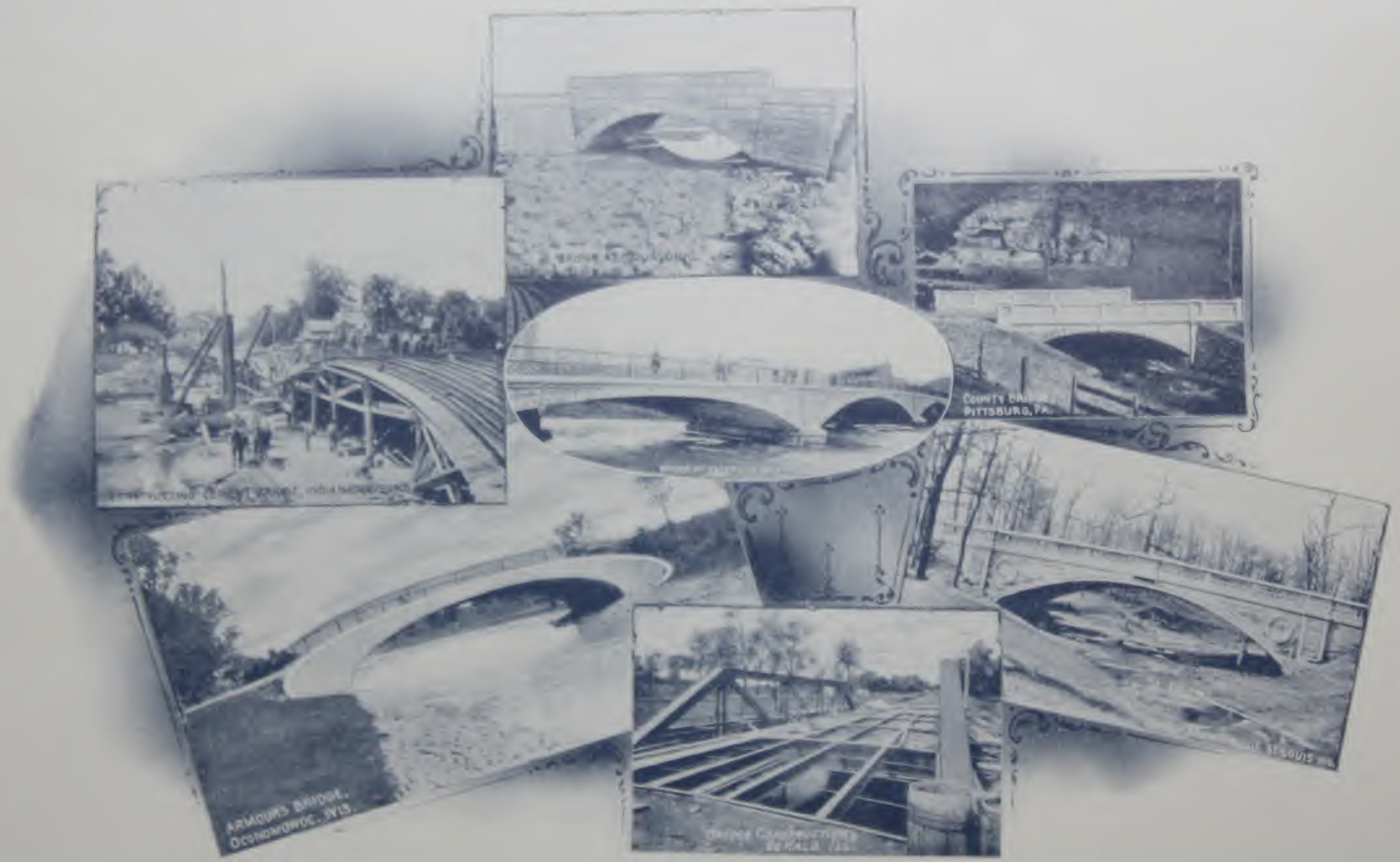
In government work vast quantities of cement are used in the construction of forts, batteries, gun emplacements, dams and locks, sea walls, breakwaters, piers, docks and jetties, lighthouses and marine dry docks. Large quantities of cement are being used in rough concrete masonry for pier foundations for office buildings, one noticeable instance being the First National bank building at Chicago now under way. This building will be carried on 110 pier foundations from 9 to 12 feet in diameter by 101 feet deep constructed entirely of cement concrete. Chicago architects are advocating deep pier foundations, carried down to bed rock—built up of cement concrete, as the only safe and reliable foundation for high buildings to be constructed in the future in Chicago. This will call for large orders of Portland Cement. In grain elevators, large factory buildings and power houses, concrete masonry is the favorite material. The railways find it economical to use concrete for piers, bridges, culverts, retaining walls for elevating and depressing their tracks, for floors and roof coverings in shops and depots.

The railways are likewise beginning the erection of grain elevator tanks at terminal points in armored concrete.—*Cement and Engineering News, August, 1902.*

This illustration shows armored cement concrete piles being driven for wharf purposes at Southampton, England. These piles are jointed, and constitute a real, substantial wall of the most approved construction. Numerous applications of these piles have been made for the foundations as well as for wharf walls They are indestructible as well amongst the atmospheric agents as by the creatures (teredos etc.), which live in the warm seas. In Holland all the houses have this foundation on piles of 65 to 70 feet. Very high buildings in that country, buildings of an absolute solidity, are constructed because the solid ground can be reached by means of these rigid foundations—armored cement concrete piles.

In the new docks of the Holland-American Line, at Rotterdam, more than 400 piles in armored cement concrete were driven to a depth of 65 feet. Each pile weighed 8 700 pounds.

For the foundations of the bridge of Tangon (France), piles were employed 92 feet long, driven down in three sections, and it is a very fine example of the use of cement concrete piles.



CEMENT BRIDGE CONSTRUCTION.

The Piqua Bridge is a cheap, plain but durable style for small bridges in rural districts. The Indianapolis Bridge illustrates the method of imbedding iron beams in cement concrete for the Melan Arch. The Armour Bridge shows the graceful low flat span possible in the Melan Arch system of bridge construction. The DeKalb Bridge has a floor of cement concrete slabs held in place by steel I-beams. The railing as well as the arch and floor of the Pittsburg Bridge is made out of Portland Cement, expanded metal being used in its construction. The Paterson Bridge has three flat Melan arches, from 89 to 91 feet in length. It spans the Passaic River in the heart of the city of Paterson, N. J., and is 54 feet wide. It carries a double track electric railroad and heavy traffic. The St. Louis Bridge shows elaborate decoration possible on the concrete arch. The entire structure, including face and railing with balusters, is molded from Portland Cement.

PORTLAND CEMENT BRIDGE.

A most wonderful demonstration of the strength and beauty of Portland Cement concrete bridge construction, built at the Northwestern Trade and Industrial Exposition, Bremen, Germany.

Over 80 000 barrels of Portland Cement were used in constructing the Cleveland Breakwater. The cut shows an angle of the Breakwater, top surface and parapet. The Marseilles jetty extends into the Mediterranean over two and a quarter miles and is built up from large cement blocks dumped somewhat promiscuously into the sea.

Plans for improvement of the government harbor of refuge at Harbor Beach, Mich., to cost $300,000, are now being made by the government engineers at Detroit. The entire crib work above water will be replaced with cement concrete, and this work will extend over two miles. The harbor will be dredged to a uniform depth of twenty feet.—*Cement and Engineering News.*

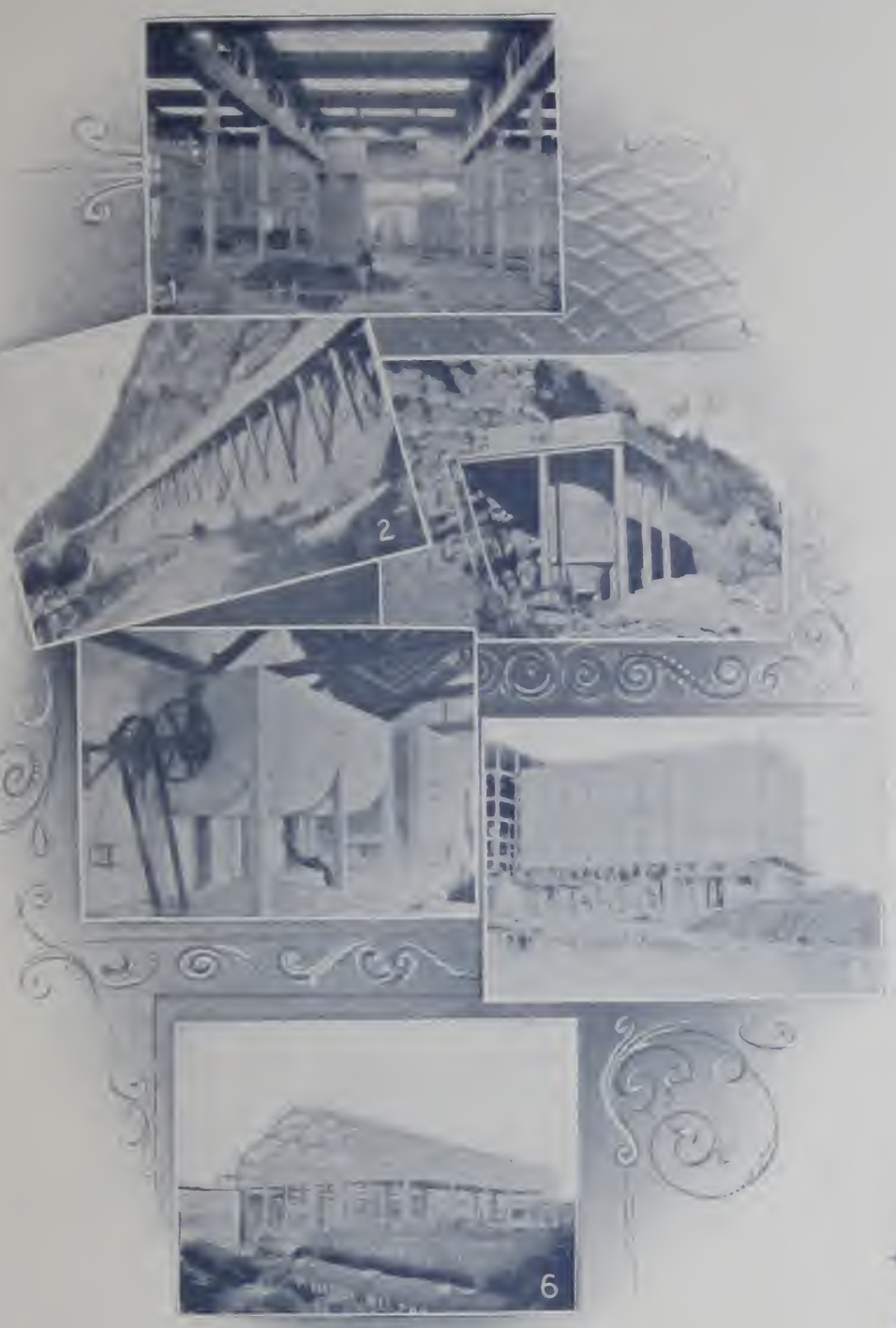
At Sault Ste. Marie, Mich., a board of government engineers has been in session preparing recommendations for the best method of extending the lock system. The board will recommend the construction of an entirely new cement concrete lock which will give passage at one time to three of the largest ships on the lakes. The canal above will be widened to 500 feet.—*Cement and Engineering News.*

The crown of the reservoir is of solid cement concrete. The short lengths of cement sewer pipe shown are two or three feet in diameter and are made in crude moulds without expensive machinery and need no burning but only maturing by being kept wet for a few days. The bottom illustrates a very remarkable test made in June, 1901, by the New York Expanded Metal Co., on a portion of the conduit for the Jersey City water supply. Fifteen days after the section had been made, *25 tons of steel rails were piled on the section.* Three rails weighing approximately a ton were then twice dropped on one end of the loaded arch; all this produced only a deflection of *1/20 inch* in height of arch, with a few cracks. On removing the rails a half month later *the arch resumed its original form with practically no damage.*

Portland Cement Work, Duluth Ship Canal.

The south canal pier at Duluth, Minn., done in blocks of concrete weighing 100 tons each, laid in alternate sections.

The U. S. Government will spend over a million dollars in making protective piers for the harbor entrance at Superior, Wis., 6 miles from the afore piers at Duluth. In the office of the Government Engineers at Duluth, Minn., specifications are now being made out. These will be the largest monolithic cement concrete piers ever built in the U. S. They will be solid concrete from the foundation, 25 feet below water level, to the top, 10 feet above water, and they will be 1,200 feet long. *Several hundred thousand barrels of Portland Cement will be required.—Cement and Engineering News.*



HENNEBIQUE STRUCTURES.

No. 1 shows construction of the Singrun machine shop at Golbey, entirely framed in concrete, including beams to support a movable crane of 30 tons weight.

No. 2 gives a view of the Simplon canal, built along the abrupt mountain side to conduct the water of the Rhone for motive power to Brigue, Switzerland, a distance of two miles. The canal itself and the entire trestle work supporting it are built out of concrete.

No. 3 shows a lime kiln at Luzech built out of cement in which a constant temperature of 1,200 degrees heat is maintained.

No. 4 is the picture of a cement grain elevator at Strassburg, containing 45 bins each 50 feet high.

No. 5 gives interior view of a paper mill at Pelgues. Cement pulp-vat floors and partitions are noteworthy.

No. 6 illustrates a use for Portland Cement entirely new in America, but very popular in Europe. It shows the complete framing of a building in concrete, girders, plates, rafters, all formed in cement by the Hennebique system. The structure is erected for the Babcock & Wilcox Co., and employs cement girders of 40-foot reach.

The Columbia, one of the cruisers belonging to the United States Navy, is lined with Portland Cement. This material at the age of one year will stand a crushing strain of 220 tons to the square foot. Portland Cement gives twice as great buoyancy as the steel which it replaces.

Various forms of artificial stone already in use, showing clearly the adaptability of Portland Cement to every conceivable problem involved in architecture.

PORTLAND CEMENT SILO AND WATER STORAGE TANK

On the farm of Ex-Governor John T. Rich, Lapeer, Mich. Peninsular Cement used exclusively.

Wood decays readily in such structures, ordinary masonry is not impervious to moisture, metal is expensive and corrodes, and none of these materials afford permanent structures or remain for any length of time air-tight. The above illustrated use of Portland Cement is making a strong appeal to the progressive stock-raiser, and many thousands made of this material are now in use.

A cement silo is not affected by the juices of the silage, is non-corroding and impervious to moisture, and can be made absolutely air-tight to last for generations.

PORTLAND CEMENT SILO

On the farm of Thomas Hodgins, London, Ont. Peninsular Cement used exclusively.

Water Tank constructed entirely of Portland Cement, at Clark Lake, Mich.; capacity, 25 barrels. Thousands of these tanks are now being constructed throughout the country.

The American farmer is giving close attention to the use of concrete, which he is beginning to use in place of wood, stone and brick. We have been receiving on an average five orders per day from farmers for books on the use of concrete constructions, which is indisputable evidence that a large demand for cement is being created by the farming community. — *Cement and Engineering News.*

Mr. Bruce Coltrin, of Jackson, Mich., will erect sixteen concrete cottages, to be rented to workmen at $7 to $8 per month. Every part of the construction will be of Portland Cement, except doors and windows. The same party will erect a concrete store building during the present season.—*Cement and Engineering News.*

The beautiful Club House of the Detroit Boat Club, Belle Isle, is of Portland Cement concrete construction throughout.

AMMONIA TANKS, RACINE, WISCONSIN.

Built entirely of Portland Cement concrete and expanded metal. They are used for the storage of tar and ammonia. The resistance calculated is 500 lbs. per square foot. The concrete used was one part cement, two parts sand and five parts broken stone. They have been in use since 1906, and have answered every requirement without damage or harm.

A SHORTAGE IN CEMENT.

The latest shortage is in cement, and prices have jumped from $1.75 a barrel to $2.54 since spring, and city sidewalk pavements are being delayed. The delay is not serious, since the contracts are pretty well distributed among the local contractors, but the contractors are feeling the advance in price keenly. The rise does not affect the city because the municipality secures its cement under contract at a uniform price of $1.75 a barrel. To relieve the situation, the local men are offering to use foreign and new Canadian brands of cement if they will stand the test. A dozen tests were made last week and four brands were found wanting.

—Toronto Star, Sept 23, 1903

PORTLAND CEMENT CONCRETE PAVEMENT.

The base of the pavement is made of 1 part Portland Cement, 3 parts sand and 5 parts screened gravel. The top is 1 part cement to 2 parts sand. Coarse brush finish was given the surface. Similar pavements are now in general use in many other cities and are giving splendid satisfaction — in many instances have stood years of wear without the expenditure of a dollar for repairs, and are still in perfect condition. Philadelphia, Pa., New Orleans, La., and many other cities are using Portland Cement paving quite extensively.

In various parts of England, Germany and other European countries cement concrete pavements have been in use for years.

GRAND RAPIDS, MICH.

USE OF CEMENT IN BUILDINGS.

"The increasing use of concrete in the erection of buildings at the present day has worked many radical departures from previous methods of construction, and the end is by no means in sight. Its use is especially desirable, not only in structures where great strength is desired, but the increase in insurance rates, the feeling of insecurity against fires, the high price of lumber, paints and oils, and the repairs continually required to keep the present style of dwelling houses comfortable and habitable will eventually,and in the near future lead to a more extended use of cement in building private houses. A steel frame structure with concrete walls, foundations and floors gives us the ideal building in which cleanliness, permanency and safety is desired. A building erected on these lines with a slate roof would need but few repairs and only at long intervals, and would be thoroughly fire, wind and weather proof. Being impervious to atmospheric changes the cement walls and floors would ensure an even temperature against the extremes of heat and cold, giving the much desired result of a house cool and dry in summer, and warm and dry in winter. The cry that cement manufacturing is overdriven is puerile, for though cement construction is yet in its infancy the demand for the raw material is greater than the supply "—*Cement and Slate, Sept., 1902.*

INCREASE IN PRICE OF CEMENT.

There has been a steady and unusual rise in price of building cement during the last two months, due to a variety of causes, but principally to the extraordinary demand for that character of construction material which has been and is beyond the capacity of the cement mills to supply.—*Cement and Slate.*

WASHINGTON, D C., Oct 27, 1902.

PENINSULAR PORTLAND CEMENT CO.,
Jackson, Mich.

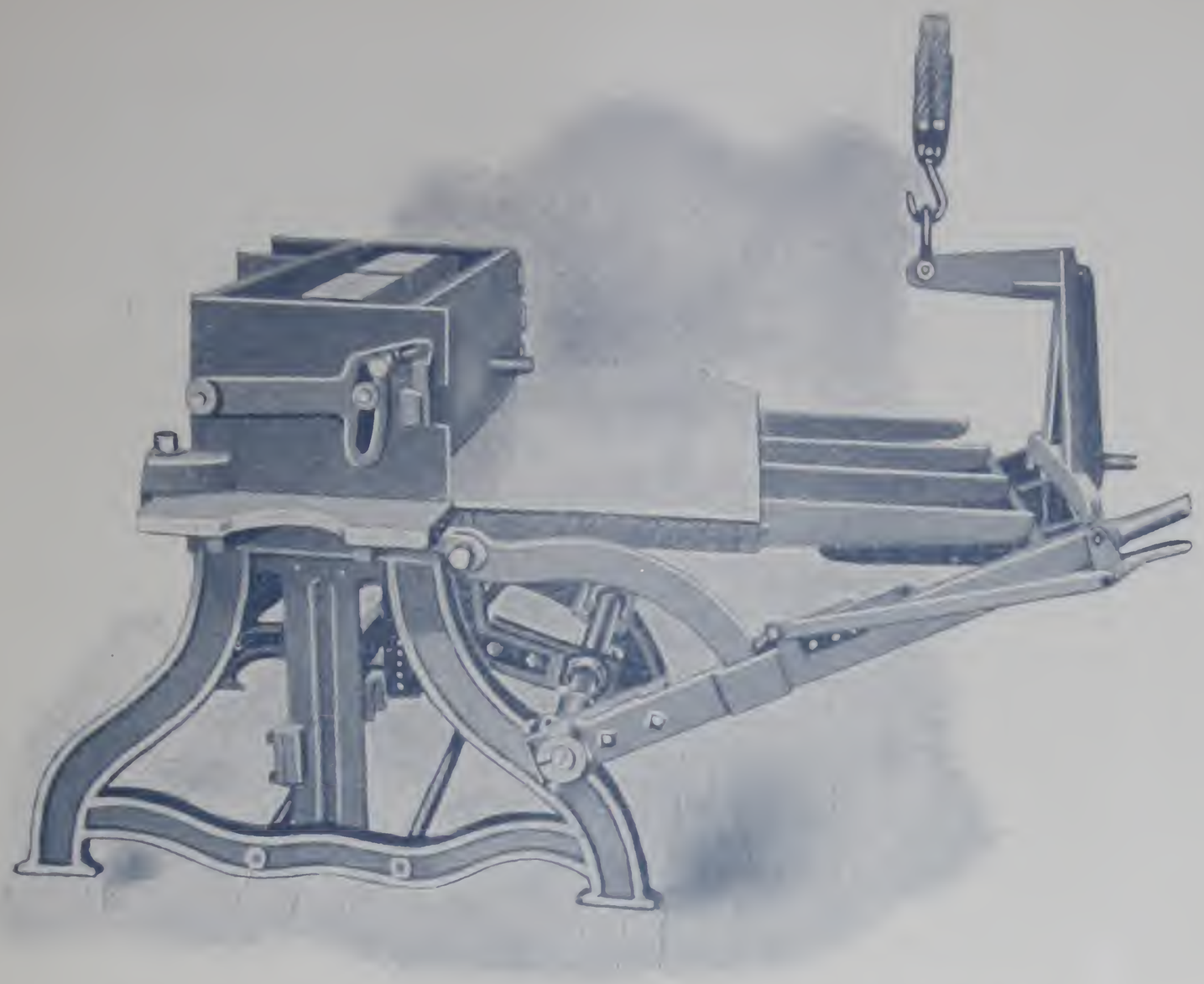
Gentlemen:—It is evident that the demand for Portland Cement far outstrips the supply The age of cement that I predicted ten years ago as published by you in your souvenir catalogue has indeed arrived. Letters flow in upon me from all parts, making inquiries of me upon the subject.

Yours truly,
FRANKLIN WEBSTER SMITH, Pres't
National Galleries History and Art, Washington, D. C.

The Wolverine Brass Co., of Grand Rapids, Mich., is now erecting its new building for its casting department, the first building in the city to be constructed of hollow cement blocks. The blocks are laid in Portland Cement, giving solid joints and making of the wall a practical structural unit The hollow interiors of the blocks form conduits in the walls in which gas and water pipe may be laid and give an air space which, it is claimed, will moderate extremes of temperature in summer and winter.—*Cement and Slate, October, 1902.*

The Villa Zorayda, Mr. Franklin W. Smith's winter home in St. Augustine, a cement concrete monolith of elaborate construction, modeled after the Palace of the Alhambra, and erected in 1883.

The City of Montreal, Can., has just passed a law requiring all manufacturers of food products to have cement floors in rooms used for storage and manufacture.—*Cement and Engineering News, November, 1902.*

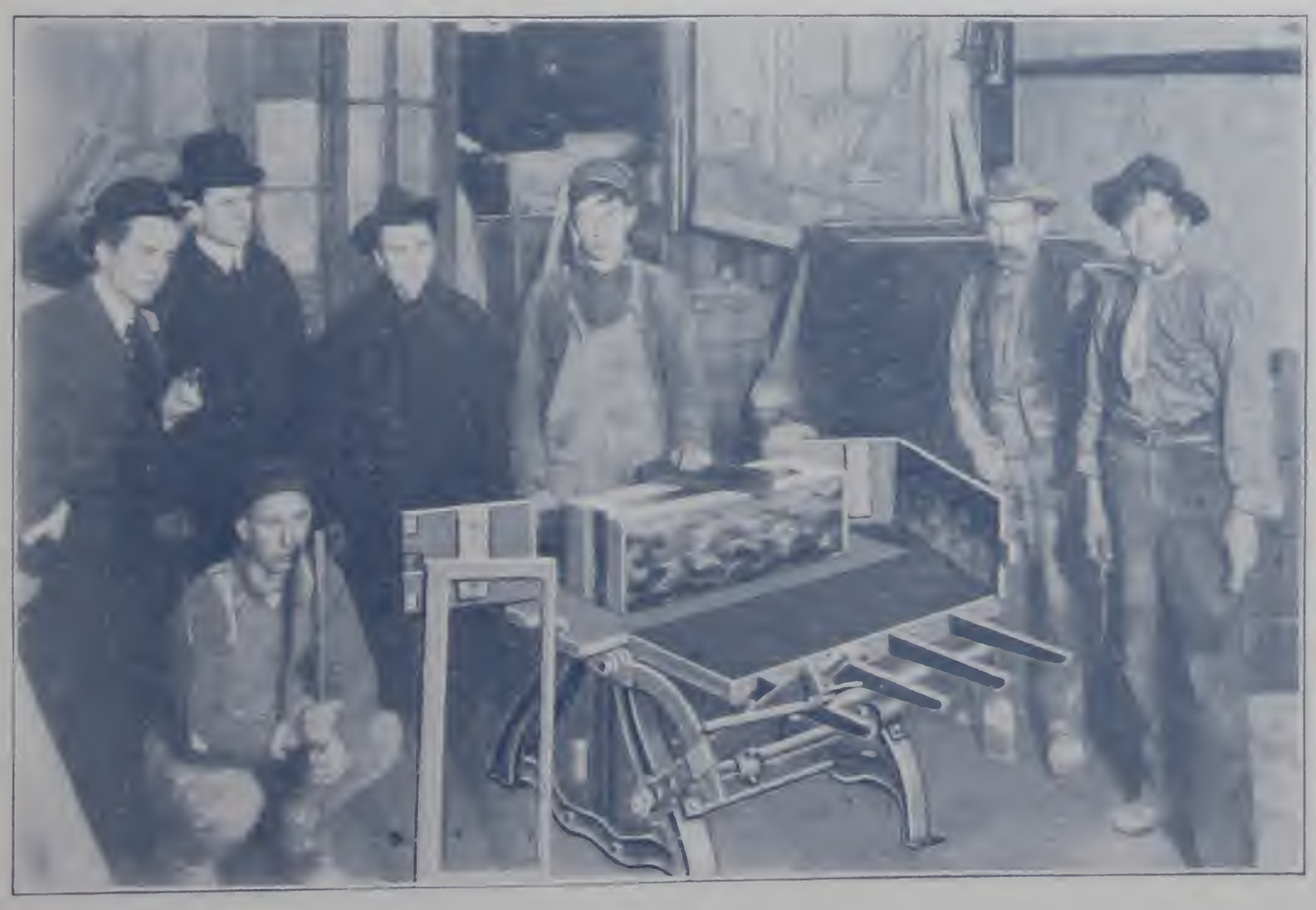


Normandin Cement-Concrete Construction Block Machine. (Style "A.")
Eight Machines in One.

CEMENT BUILDING BLOCKS.

Quite a novel test of a machine took place at E. J. Tobin & Co.'s place on Pearl street yesterday. Four men using a moulding machine, known as the Normandin, succeeded in making cement blocks, 30 inches long and 10 inches wide and deep, at the rate of one a minute, and went one better several times by finishing in 45 seconds.

These blocks are composed of fine gravel and cement, and are used in place of ordinary brick. The moulding machine is made by the Cement Machinery Co. of this city, being cast at the Holton & Weatherwax foundry. They have orders for 100 machines for the next three months' delivery, and are expecting to erect a factory of their own. The most important factor is that these cement blocks can be made 20 per cent cheaper than ordinary brick. The test reveals the fact that they can be made so fast that not only cheapness, but every other element of manufacturing is improved upon.—*Jackson Daily Citizen, December 13, 1902.*



CEMENT RESIDENCE OF DR. ROBINSON, JACKSON, MICH.
Under process of construction.

The railway companies are among the heaviest purchasers of Portland Cement in round lots. In this connection a statement made by President Ingalls of the Big Four Railway, is in point. He said "that Portland Cement is adaptable and desirable for public works and all permanent improvements is sufficiently proven by the fact that leading railways have discarded other materials for cement. A possible objection to cement is that it is next to impossible to tear down or make changes in structures built of Portland Cement concrete. It is likewise the greatest fire resisting material we possess." This is sound logic from one of the most eminent railway specialists in the country, who has made a special study of Portland Cement construction and is showing his faith in this material in the erection of the first fifteen-story office building in armored concrete in the United States, at Cincinnati, Ohio, which building is now under way. The railway companies of the United States have or are rapidly installing concrete construction departments, and are yearly increasing their orders for cement.—*Cement and Engineering News, December, 1902.*

Group of Cement Concrete Construction Blocks.

"The cement market shows signs of steady advance in price, and the demand continues to be far ahead of the supply."—*Baltimore Cement Exchange, 1902.*

The Arroyo Ditch & Water Co. of Downey, Col., has just finished a six mile cement flume.

The German steamship Pontos, from Hamburg, brought 25,000 barrels of German cement to New Orleans. The consignment was to local importers.—*Cement and Engineering News, September, 1902.*

And still we hear about methods for the manufacture of artificial stone.—*Rock Products.*

The Chicago & Alton Railroad has decided that the wooden platforms around its stations must be abolished in the interests of safety and durability. They will as rapidly as possible be replaced by concrete. The Portland Cement platforms can easily be kept clean and are much more durable and but little more expensive than the old ones.—*Cement and Engineering News, December, 1902.*

POLISH CHURCH, BAY CITY, MICH.

Under process of construction, being built of Normandin hollow Portland Cement concrete building blocks

The Church of Christ at Durand, Mich , is constructed of Portland Cement concrete throughout, and was dedicated on January 12th. The structure is one of the largest and most substantial buildings in Durand.—*Cement and Engineering News.*

Messrs. Bates & Edmonds will erect a Portland Cement concrete factory building on Mill Street, Lansing, Mich., 200x50 feet. An architect is now preparing plans, and as soon as they are completed the contract will be let and the work of construction commenced.—*Cement and Engineering News, August 7, 1902.*

THE EDISON ELECTRIC BUILDING, GRAND RAPIDS, MICH. (50 x 100 ft.)

The foundations, walls, floor and roof are of Portland Cement concrete. The walls are built of plain hollow blocks, made with the Normandin block machine shown on another page.

Chemical Laboratory of the Great Works of the National Portland Cement Co., Durham, Ontario.

Constructed entirely of Peninsular Portland Cement—hollow concrete building blocks used exclusively. Warm in winter, cool in summer, impervious to moisture, absolutely vermin and fire proof.

EXPECTS A GREAT DEMAND FOR CEMENT.

The Vulcanite Portland Cement Co., Real Estate Trust Building, Philadelphia, Pa — Replying to your inquiry in regard to the outlook in the cement trade, we beg to advise you that the increased capacity of the Portland Cement mills will practically have no effect on prices for the coming twelve months. This is due from the fact that every indication points to an even larger demand for 1903 than that of 1902. The shortage of 1902 was about five million barrels. Some expert statisticians assume the shortage for 1903 will be about ten million barrels. The increased capacity will hardly amount to two million. The manufacturers will probably endeavor to keep the prices down in the neighborhood of $1.50 bulk at the works, in order to avoid any possible restrictions in the use of Portland Cement. The increased demand is largely due to the increased usages Portland Cement has been put to during the past year and a half. It is not likely, however, that they will be able to keep the prices down to this figure, as the demand being far greater than the supply, will cause prices to jump toward the middle and latter end of the season. —*Rock Products.*

Mr. James J. Hill, President of the Great Northern Railroad purchased twelve hundred tons of Belgian Cement for use in lining a tunnel to be built by his Company, east of Seattle, and a fleet of sailers has been chartered to import the Cement.—*Cement and Engineering News, December, 1902.*

The Southern Railroad on December 31st, moved out of Charleston, S. C., two special trains carrying fifty-five car loads each of Portland Cement to be distributed throughout a number of interior Southern points. The cement was shipped from Pennsylvania by steamer and was transferred to cars at Charleston.—*Atlanta Constitution, Jan. 15, 1903.*

Terrace Wall, Bay View, Mich., made entirely of Portland Cement concrete building blocks.

A SEVERE TEST OF PORTLAND CEMENT CONSTRUCTION.

For the first time in five years Niagara was out of harness Sunday, June 1. The rush of water into the great tunnel of the Niagara Falls Power Company was shut off, and the full volume of the river poured over the falls. The managers of the company wished to ascertain the condition of the tunnel after the discharge of 32,400,000 cubic feet of water each hour for five years. At 1:30 o'clock that Sunday morning a party of engineers composed of Vice-President William B. Rankine and Edward D. Adams, of the board of directors; William A. Brackenridge, resident engineer, and Clemens Herschel, consulting hydraulic engineer of the Niagara Falls Power Company, and others, put on rubber suits and descended into the tunnel. Splashing along through a stream eighteen inches deep, caused by the leakage at the gates, they flashed their torches upon the walls in anxious search for signs of wear. They found none. From one end to the other, the tunnel was as strong as on the day when it was finished. The inspection was finished by 7 o'clock. The engineers returned to the surface of the earth, the gates were lifted, and one-thirteenth of the mighty stream of Niagara plunged again into the tunnel. —*Cement and Slate, October, 1902.*

CEMENT CONCRETE OUTWEARING BED ROCK.

The above illustrated portion of the Mechanicville Dam was built for the Hudson River Power Transmission Company, entirely of cement concrete, and is 16 feet high, extending from an island in the Hudson River to the east bank, a distance of 800 feet. The waste gates shown in the cut were some of them only ten days old when the Hudson River was diverted from its banks and run through them. On being examined the next year it was found that the exposed concrete was practically perfect, while the bed rock of the river had been excavated by the scouring action of the current, leaving holes to the depth of 10 feet in places on the down stream side, above which the cement piers overhung SQUARE-CORNERED and practically UNHARMED.

CEMENT IS SCARCE.

Order for 50,000 Barrels Goes Begging from Plant to Plant All Over the Country.

(Special Telegram to the Despatch.)

LOUISVILLE, Aug. 17, 1902.—A scarcity of Portland Cement is threatened in the United States, according to R. H. Evans, a local Portland Cement man. Mr. Evans had occasion recently to buy 50,000 barrels of Portland Cement for a Winnipeg concern, his company not being able to fill the order. He wrote to 22 different companies in nearly as many cities, and the best he could do was to place part of the order. A firm at Youngstown, Ohio, reported its output sold for a year ahead. Detroit refused to quote prices: "far oversold" came the reply from one Philadelphia concern, and another reported its output contracted for, for the next ninety days. From New York, Bronson, Mich., Union City, Mich., and a dozen other points similar answers were received.—*Pittsburg, Pa., Despatch.*

BANK BUILDING IN LEIPZIG, GERMANY.

This building is constructed entirely in Armored Cement Concrete, Hennebique System, viz.: floors, columns, footings, roof (which is in cinder concrete), as well as the walls are all constructed of Portland Cement.

Portland Cement is the finest non-conducting fire-proof material ever produced. It is as nearly impervious to heat as anything ever discovered. It costs only about one-half in fuel to heat a large residence so constructed than if it had been built in the ordinary way.—*Detroit Tribune.*

The Oklahoma City Stone Manufacturing Co. has just completed a large four-story building for the Armour Packing Company, constructed entirely of hollow Portland Cement building blocks. —*Municipal Engineering, December, 1902.*

The British ship Slieve which recently arrived at Seattle, Wash., brought 2,450 tons of Belgium cement —*Cement.*

PUNAHOW PREPARATORY SCHOOL BUILDING, HONOLULU, H. I.

Built entirely of Portland Cement concrete. Dimensions, 145x83 feet. Walls are 12, 10 and 8 inches thick.

It is interesting to note that the building authorities of the islands of the far Pacific have shown a capacity to grasp progressive ideas in general building construction in so creditable a manner as is illustrated by the erection of this important building entirely of cement concrete. Among other important buildings erected in Honolulu of this material are the Automobile Building, 80x200 feet, in general measurement, and the Club Stables, 72x56 feet.

CENTENT RESIDENCE, PASADENA, CAL.

PORTLAND CEMENT RESIDENCE, PITTSBURG, PA

RESIDENCE OF ELIAS LEMON, OWEN SOUND, ONT.

Constructed entirely of Portland Cement.

The walls of the Ponce de Leon are built of concrete made from Portland Cement and Coquina sand. This hotel is probably more widely known than any other in Florida.

The Green Hotel is a magnificent structure in Southern California. Its walls are cement concrete embedding expanded metal. It is thoroughly fire-proof throughout.

HOW TO USE PORTLAND CEMENT.

Character of Materials used with Cement

SAND should be clean, sharp, coarse and free from loam or any other adhering matter. The importance of such an article in cement constructions cannot be overestimated. Doubtless the day is not far distant when sand, too, will be selected and tested as to fitness for its purpose. If a small quantity of the sand to be used, stirred in a tumbler of clear water, muddies it much the sand should be washed before being used. Chemically, the sand should be as purely silicious as possible, free from alumina and iron. Physically, it should be angular and rough though regular in size and not too fine or it will weaken the work. Its use in construction is the economy of cement, prevention of shrinkage, and the taking up of stresses due to expansion by heat.

Sand, Its Condition and Use

Gravel or crushed stone should be clean and vary from one-quarter to two inches in size. Washed cinders or broken brick answer the same purpose. If work is done during winter months care must be taken to prevent freezing, warm water being preferable to cold in mixing concrete. Salt dissolved in the water will prevent freezing and is said to be not otherwise harmful than in producing at times an unpleasant efflorescence on the surface. A suitable proportion is an ounce of salt for each gallon of water at 29 degrees Fahrenheit, increased by one-fifth ounce per gallon for each additional fall in temperature of one degree.

Gravel or Crushed Stone

Preventing Freezing

Various proportions of sand and stone are mixed with one part of cement in concrete work, but for ordinary purposes, such as walk foundations, mill or machinery foundations, abutments, piers, etc., two or three parts of sand with from five to seven parts of crushed stone are mixed with one part of cement.

Proportions

In mixing, all materials should be actually measured by volume. Mix cement and sand together by turning with a shovel until it shows a uniform color, usually three or four times turning will accomplish this; then add the necessary quantity of water and the required amount of stone previously wet, using only sufficient water to bind the materials together so that when thoroughly mixed by a shovel the cement will not crumble or fall from the rock fragments. Too much water weakens concrete. Moisture of air and sand, and temperature at time of mixing, are varying factors in determining amount of water necessary. Where large quantities of concrete are required, machine mixing is preferable to hand mixing, both for economy and for better and quicker work; but any machine to be highly successful should provide for mixing thoroughly the dry sand and cement before wetting it.

Hand Mixing

Machine Mixing

See that the mixture, resembling moistened earth, is rammed properly into place in thin layers with a tamping iron till it shows a little moisture on the surface; put down quickly so that the layers adhere to each other. After concrete has become set, wet frequently with abundance of water for several days, especially on sidewalk work.

Laying

Cellar floors should be from three to four inches thick, concrete to vary in strength in proportion to the use the cellar is put to. For ordinary purposes a concrete mixture of one part cement, five parts sand, and ten parts stone will be sufficient. Top surface to be made same as sidewalk surface: one cement, one sand. One barrel of high-grade Portland Cement will lay about seventy-five square feet of good cellar floor.

Cellar Floors

For masonry and brick work, use one part of cement to five parts of clean sharp sand, adding about one-half part of fresh slacked lime to give the mortar a plastic nature in handling and to add to its adhesiveness, density and strength. Cheaper mixtures may be made by using with each additional two parts sand, one-half additional part lime paste. One barrel of high-grade Portland Cement should be sufficient to make enough mortar to lay up two thousand bricks, with quarter-inch joints. Bricks to be laid in cement should be soaked so as to prevent their absorbing from the cement the moisture it needs in setting.

Cement Mortar

Portland Cement mortar has valuable hydraulic properties, and is quick hardening, so that it can be used under water or in cold weather where no other mortar could be

Why Used

used. It is weather-proof and comparatively free from expansion and contraction, and has a much greater crushing and tensile strength than either lime or natural cement mortar.

Sidewalks

In laying sidewalks, depth of excavation depends greatly on soil; ordinarily about fifteen to eighteen inches should be excavated, and filled up to within four to six inches of the level with good ashes, cinder, gravel or stone, sprinkled and rammed well to prevent winter frosts from heaving pavement. Side strips of two-by-four should be set to keep walk in proper shape; then fill to within one-half inch of top of strips with concrete properly prepared; proportions either three parts sand, seven broken stone, to one cement; or even four parts sand, eight parts gravel or six parts broken stone, to one cement. Ram well, and before the sub-surface is hard set, clean and roughen it, fill the remaining one-half inch with top surface, composed of one part cement to one or two parts good sand, or coarsely ground marble dust or limestone, or trap rock screened from one-sixteenth to one-eighth inch in size. Obtain an even surface by working the top dressing backward and forward with the edge of a level board, resting on edges of strips on sides of walk; having worked it sufficiently to fill all pores, smooth the even surface by troweling it, but do not trowel too much, for excessive troweling produces air cracks. Blocks should be laid in four or five foot squares. A good plan is to lay every other block, returning to lay intervening blocks when the first are sufficiently set to allow removal of strips. Blocks should be kept from adhering closely together. Water-proof paper may be laid between them to accomplish this. For good work, dusting is to be avoided; but in case an excess of water be present on surface, it may be removed by dusting with mixture even parts sand and cement. However, if care is taken in previous mixing this will be unnecessary. The surface may be roughened or corrugated by using a roller or other device before cement has had its final set, never disturbing it after setting. When the cement has

PEAVEY GRAIN ELEVATOR, DULUTH, MINN.

These bins are 15 in number with capacity sufficient to hold about a million bushels of grain. Each is over 100 feet in height and more than one-third as large in diameter. The entire structure is in Portland Cement concrete and planned somewhat after European models that have given unqualified success for years. The work of construction was completed during the year 1900 at a cost approximating a half million dollars.

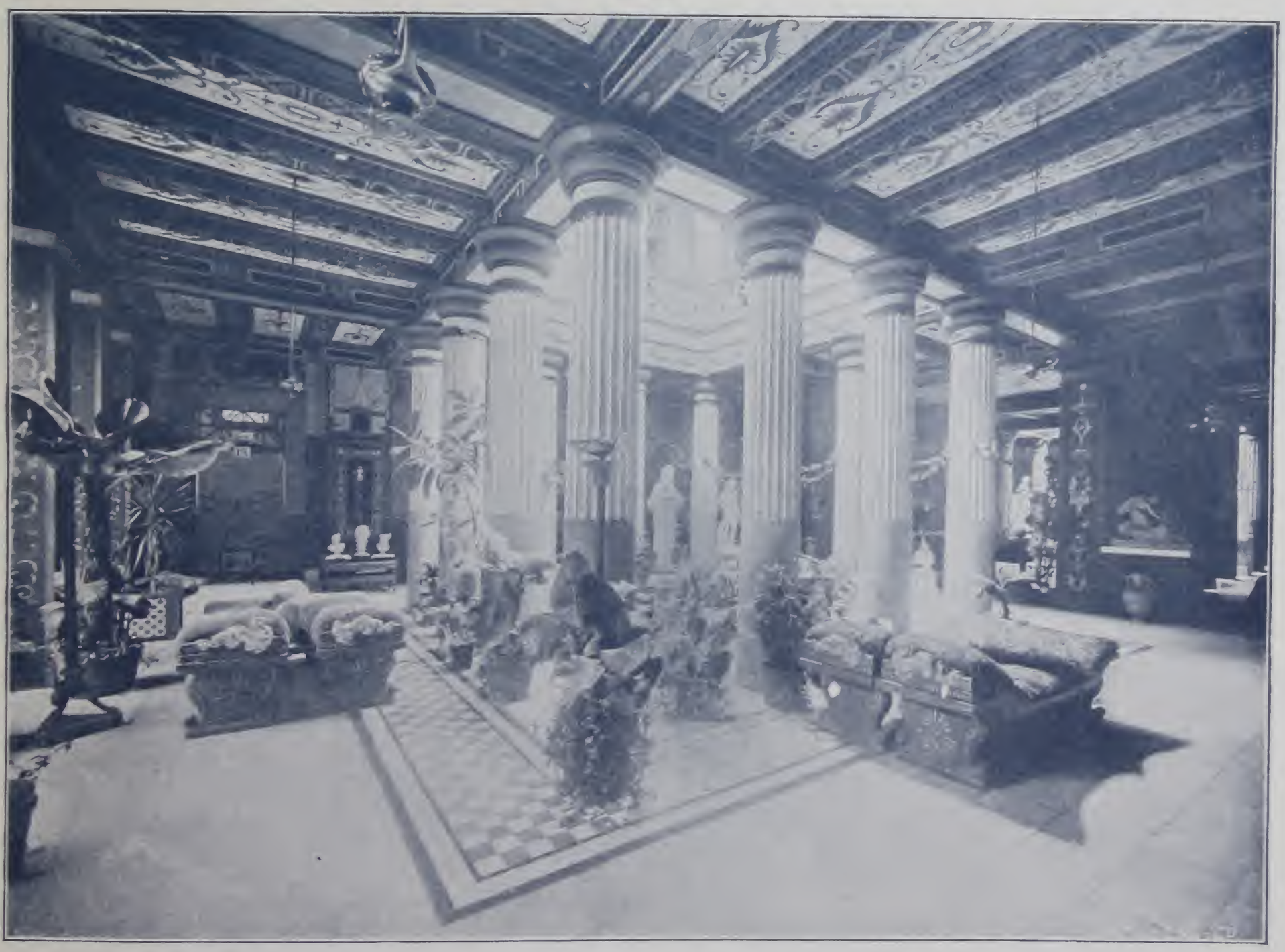
thoroughly set, the surface should be kept free from dirty water or dirt to give uniform color and be carefully covered over and kept moist for several days, thereby preventing cracks and obtaining a clean solid surface. A soft light gray effect may be given the surface by mixing with the dry cement about three-quarters of a pound of lamp-black to the barrel. Walks laid as suggested above will require seven to ten pounds of cement to the square foot. One barrel of high-grade Portland Cement will therefore lay about forty-five square feet of good sidewalk.

Curbs

Curbs and gutters should be made in one so as to bind together, and should be at least five inches thick at top and seven at bottom, sloping mostly on the walk or filled side so as to overcome the pressure outward on the top of the curb. They should be set in the ground fully six inches, and be in lengths of four or five feet. Surface of curb should be finished with a coat, one cement, one sand, and be carefully worked and troweled as soon as retaining board can be removed to admit of same. The edges should be beveled off, leaving no corners for contact with carriage or wagon wheels.

Street Crossings

Probably the best known material for street crossings is Portland Cement. Recently it has been extensively used for this purpose. Such a crossing is made having an arched top with the center slightly above the street level. Rains wash it and from its shape the center soon dries, leaving a clean footing. The crossings are made like walks, five or six inches thick, with heavier topping according to the usage they are to receive. Sand for topping should be coarser than when used for sidewalk surface. In many cases these crossings are made on the grade of the sidewalk, bridging the gutters with a flat top arch and merging into the sidewalk, thus making easy access from the street. City authorities need only to see these crossings in use to adopt them on the spot.



PERISTYLIUM IN THE POMPEIA AT SARATOGA, N. Y.

The floors, walls, pillars, architraves, etc., all made out of Portland Cement, have had fourteen years' wear and are as perfect to-day as when completed in 1889.

BELIEVING that men in general act according to their best judgment and modify their judgments by their own experience and that of others, and that intelligent men are seekers of truth and welcome it wherever they find it, we purpose making this book an educator for men willing to know the truth concerning best methods of building involved in the modern reform movement now going on in construction work.

Men of the business world are all looking for the best thing and the most of it for the least money. They want what the devastating elements cannot rob them of and what will therefore be as good to-morrow as it is to-day. There is no field in the world where this desire should be more intense than in the construction arts.

Such thoughts as these have inspired us in gathering much of the material arranged in the preceding pages to acquaint men with the merits of the one thing best in building materials, Portland Cement.

THE great Works of the Cowham System of Portland Cement Mills are in constant operation, and if you want a good cement, buy your product from a progressive, wideawake organization, where most approved modern methods are used in its production. They can give you the best. You get what the world cannot better when you buy

THESE BRANDS.